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GARDENING IN CEYLON.

While there is no doubt that local gardens have much improved in the last 15 years, the general standard is none the less a low one, and, with the increasing prosperity of Ceylon we may hope to see it rise. The wages of garden coolies are decidedly on the increase.

One thing that militates against good gardens is the fact that people are so continually on the move, and think that it is waste of time and money to lay out pretty gardens. If they would remember their successors in all cases, this need no longer be an operative cause of poor gardening, but this we fear will be long of coming. Would it be possible for estate Companies, for example, to compel the bungalow garden to be kept in good order, the V. A. to be the judge?

Another thing is the ignorance of the garden owners, and this is perhaps the most important of all. They employ only a cooly, not a trained gardener, and consequently are not able to get really good results unless they have themselves some knowledge of gardening. It is very desirable that greater knowledge of this kind should spread abroad, but how best to spread it is a difficult question. If every one would take a personal interest in their garden, spend time and labour upon it, and note the results of doing everything in this way or in that way, so as to learn rapidly by experience, a great deal would be done.

Many of course cannot afford a good garden unless they can get something out of it, and to these we would suggest growing quantities of vegetables or fruits and thus making the garden pay.

With the publication of a book upon local gardening, more people should begin to take an interest in the subject, and pay personal attention to the work of the garden cooly to a greater extent than merely telling him to water here or there, to weed this place or that, or bring in flowers for the table.

GUMS, RESINS, SAPS AND EXUDATIONS.

THE GERMINATION OF HEVEA SEEDS.

(From the *Agricultural News*, Vol. X. No. 233, April 1911).

It has been found that the seed of *Hevea brasiliensis*, which has been imported from time to time for use in Grenada, has shown very unsatisfactory germinating power, and, in view of the cost of the seed, it was considered expedient by Mr. G. G. Auchinleck, B. Sc., Superintendent of Agriculture, to make observation on seeds grown locally, for the purpose of deciding as to what the low percentage of germination might be due. The results of Mr. Auchinleck's investigations have been presented by him in the form of a report, from which the following information is taken. They show that experience in Grenada is confirmatory of that which has been described already from other parts of the world.

Mr. Auchinleck points out that the low germinating power of imported seed is obviously due to actual sterility of the seeds, to their rapid deterioration after maturity, or to both causes acting at once. For the purpose of obtaining information in regard to the suggested deterioration, seeds from capsules which had been opened just before dehiscence took place were planted twenty-four hours after the fruits had been plucked, a few being kept, however, for three days. The number of seeds collected altogether was 975, and 160 of these were set aside as being too light. That there is a great difference in weight between the heavy and light seeds is shown by the fact that 100 of the former were found to weigh 15 oz., while the weight of the same number of light seeds was only 6 oz.; there was, however, no observable difference in size between the two kinds.

In the continuation of the experiment, all the light seeds were planted in a bed, while of the heavy, eighty were sown at stake and seventy-five in pots. None of the light seeds germinated; of the heavy, nineteen of those at stake, and thirteen in pots, gave sprouts. These results appear to justify the rejection of light seeds when those of Hevea are being selected for planting.

Observations on the rapidity with which the seeds lose weight, together with the consideration that from two weeks to several months are required for germination, led to the supposition that the rate at which heavy seeds become lighter in the soil might result in a serious diminution of their power to germinate, before the young plant has had time to pierce the hard seed coat. This led to the following experiment, undertaken to find how quickly heavy Hevea seeds may lose weight.

For the purpose, ten heavy seeds were packed in thoroughly dried charcoal, in a flask; while ten others were placed in a flask open to the air. Each lot was taken periodically from its flask, at the same time, and weighed, with the following results:—

Day of weighing.	Seeds in air. grams.	Seeds in charcoal. grams.
1st.	48·8	49·0
5th	48·5	43·5
9th	47·0	40·5
15th	45·5	38·7
20th	44.4	38·0
25th	43·0	37·5
30th	41·8	37·2
42nd	39·0	37·0
49th	38·0	37·0
54th	37·5	37·0

Calculation of the results shows that in two weeks the seeds kept in air had lost 6 per cent. of their weight and those in dry charcoal 20 per cent., the latter being about the extreme limit of desiccation; the light seeds took fifty days to reach this.

Further observations, made for the purpose of ascertaining the cause of the decrease in weight, gave negative indications that this is due to the loss of water; and it is thought that it takes place on account of the presence of a definite ferment in the seed.

The fact that the trials were commenced late in the bearing season make it impossible to ascertain if the poor germinating power is the indirect result of some imperfection in the flower, or irregularity in fertilization. It was noted, however, that the embryos of all the seeds examined appeared to be normal, and there was the interesting observation that, out of about 320 capsules, all were trilocular and three seeded, except two, which possessed four loculi and four seeds. The seeds in the abnormal capsules were subjected to a germination test, and three out of the eight gave sprouts. Attention is drawn to the faint possibility that a tendency toward irregularity in the floral organs of *Hevea brasiliensis* is indicated, with the consequent production of a low

germinating power in the seed that is eventually borne. The improbability of the correctness of such a suggestion is, however, pointed out.

The final conclusions from the investigation are given as follows :—

(1) Seeds of *Hevea brasiliensis* lose weight rapidly after maturity, the loss being apparently due to desiccation.

(2) The loss of weight appears to coincide with loss of germinating power.

(3) Desiccation apparently takes place, in some instances, even before dehiscence of the capsule.

(4) Probably, without special precaution, Hevea seeds will lose their germinating power within two or three weeks after the ripening of the capsules.

The matter of practical importance that can be deduced from these results is that no Hevea seed should be sold until it has been selected rigorously by weight and there is the additional indication that no unnecessary exposure, or loss of time in planting, should be allowed after the seeds have been received.

NEW USES FOR RUBBER.

USE OF PARA RUBBER SEEMS TO HAVE NO LIMIT—A PERFECTLY SOUND INVESTMENT.

The field for the use of Para rubber seems to have no limit, according to a report made by Consul-General James T. DuBois, Singapore, to the Department of Commerce and Labour.

Consul-General DuBois claims that money put into sound rubber companies, and managed on good business principles, is as sound an investment as can be found in any country. He speaks of the supply and demand in a manner that is encouraging to investors in rubber. His report is as follows :

As the area of Para rubber culture increases in the Malaysian Archipelago at the rate of several millions of trees a year, the question arises, will not the supply so far surpass the demand that the price will fall below the profit-giving line?

As the soil of most of the Malaysian Archipelago is well adapted to rubber culture, and as rubber can be produced at a cost of 25 cents a pound and the field for the consumption is extending rapidly throughout the world, it would seem that there is no valid cause for alarm among those who are interested in rubber estates which have been started right and are managed right.

The uses of rubber are becoming so varied that the supply must constantly and largely increase in order to meet the demand. Aviation affords a new and ever augmenting field for the consumption of rubber. The tire industry is as yet in its infancy. Food and liquid preparations, which are ever increasing, need rubber to keep the jars air-tight. Formerly balloon fabrics were manufactured solely of varnished silks, now rubber-coated cottons are coming into use, three plies of which weigh less than 5 ounces per square yard and stand a far greater strain than varnished silks. The patent pipe lighters have rubber plugs. The shock absorber to reduce vibrations on all kinds of vehicles as well as machinery, is made of rubber. Ladies' dresses are trimmed with rubber beads, and white rubber shoes for evening toilet are becoming fashionable. We have rubber stair treads, and all kinds of special rubber shoes and boots are being manufactured and widely sold. The fuses used in mining, flooring for various buildings is a probability, and even an adulterated rubber is proposed for pavement. Rubber tips for chair legs and toe caps for boots will come into common use.

The field for the use of Para rubber seems to have no limit, and the money put into sound rubber companies which have bought land by the acre and not by the square foot, and are cultivating it with care and managing the estate on good business principles, is as sound an investment as can be found in any country.—*Manilla Bulletin.*

CONFERENCE ON CASTILLOA RUBBER IN JAMAICA.

BY W. HARRIS, F.L.S.,
Superintendent of Public Gardens.

(From the *Bulletin of the Department of Agriculture*, Vol. I. No. 4.)

On January 3rd, 1911, a conference of Departmental officers and planters interested in the culture of Castilloa rubber in Jamaica was held at Hope at the invitation of the Director of Agriculture. The objects in view were first to report progress as to the yields of rubber that had been obtained from established trees in various parts of the island, secondly, to consider the question of varieties and the desirable species for trial in Jamaica and lastly for demonstrations of tapping by the most experienced operators.

A summary of the facts thus made available is here recorded.

1.—The species of Castilloa at present growing in Jamaica.

The *Castilloa elastica* of Cervantes was one of the earliest species described, and it was for long supposed that all the Ule or Hule, and Caucho trees of Mexico and Central America belonged to this species, but the large amounts of American capital that have been invested in Castilloa rubber cultivation rendered necessary the careful investigation and study of the trees which were found to vary greatly in their yields of latex and in other respects, and one of the facts that have been clearly established is, that there are many species of Castilloa instead of a single species ranging over the enormous extent of territory from Mexico to Bolivia.

In 1875, the India Office despatched Mr. Robert Cross, an experienced collector, to Central America to gather seeds of *Castilloa elastica.*

Cross assumed that the Caucho of Darien (Panama) was the same as the Ule, or *Castilloa elastica* of Cervantes and selected the forests of the rivers Chagres and Gatun, then well-known localities for rubber, for the purpose of collecting the seeds.

Mr. Cross made no botanical specimens of the Caucho trees beyond some badly preserved old leaves and seeds, so that there was no means of identifying the species with certainty on his arrival at Kew. He sent home about 7,000 seeds, all of which perished in transit. He had observed that the seeds were of a very perishable nature, and made a large collection of cuttings of the true branches.

He was shipwrecked on the Pedro Cays off Jamaica and all left the ships but Mr. Cross who refused to desert his cuttings. Eventually he was rescued by H. M. S. "Dryad" and landed at Kingston whence he sailed on the R. M. S. "Nile" arriving at Southampton in October.

From the cuttings thus obtained a supply of plants was raised at Kew and of these 57 were despatched to the Botanic Gardens, Ceylon, in 1876 and 1877 and the majority arrived alive. Plants were also sent to Liberia and the Cameroons river on the West Coast of Africa, and to Mauritius and Zanzibar on the east coast; also to Singapore. Java, Jamaica and Grenada. From Ceylon plants were sent to Calcutta, Burma and Madras, and from Singapore to Perak and Queensland.

The first plants sent to Jamaica did not live, but in the Annual Report on the Public Gardens and Plantations for the year ending 30th September, 1882, Mr. (now Sir Daniel) Morris, who was then Director, states, that "The Castilloa or Central American rubber was introduced from Kew last year (1881) and there are two plants, one of which is in good health."

It occurred to me that the plants sent here in 1881 might have been raised from some other source than the cuttings taken from Darien by Cross in 1875, and I communicated with Kew on the subject, but the Curator of the Royal Gardens assures me our plants were also raised from the Darien cuttings and that their records show that these were sent to Jamaica in 1881. One of these apparently died, but the other two grew into fine trees and the seed obtained from these produced the majority of the older trees now growing in Jamaica.

One of the original trees was destroyed by the hurricane in 1903, but the other still survives after a most eventful history since it was taken as a cutting from its home on the isthmus.

In 1882 some of the trees sent to Ceylon in 1876 flowered and fruited and sometime later Dr. Trimen, who was then Director of the Ceylon Gardens, sent a specimen and a drawing—with complete analysis of the flowers and fruit—to Kew. Sir Joseph Hooker at once saw that the Darien tree as cultivated in Ceylon differed considerably from the true *Castilloa elastica*, and that eminent botanist read a paper on "The *Castilloa elastica* of Cervantes and some allied rubber-yielding Plants" at a Meeting of the Linnean Society in December, 1885, just 25 years ago, pointing out the differences that he had observed in the structure of the several forms that he had examined. Notwithstanding this, subsequent writers persisted in referring the tree cultivated in the eastern tropics and in the West Indies to *Castilloa elastica.*

In the early part of last year Professor H. Pittier, who was for many years Director of the National Institute of Costa Rica, but has for some time been a member of the scientific staff of the U. S. Department of Agriculture at Washington, applied to us for botanical specimens of our Castilloa trees, as he was engaged in monographing the genus. Specimens were sent to him from the original tree at Castleton and from a tree at Hope Gardens. Professor Pittier states that the Castleton and Hope trees are identical and that they belong to his species *guatemalensis*.

Fortunately for growers here this species is probably one of the best that

could have been selected for culture in suitable districts in Jamaica. Most of the rubber sent from Guatemala and from British Honduras is produced by this species.

Professor Pittier in a letter to me states that for semi-arid regions, with well characterised dry and rainy seasons, he would recommend *Castilloa lactiflua* of the Soconusco district of the State of Chiapas in Southern Mexico; *C. nicoyensis* from the dry Pacific slopes of the Nicoya Peninsula in Costa Rica, and probably *C. panamensis* from Panama; while *C. costaricana* from the humid Atlantic slopes of Costa Rica, and *C. elastica* are better adapted for districts with predominant rainy weather.

Mr. Briscoe, the agricultural instructor for St. Thomas, recently discovered two small plantations of Castilloa in the eastern part of St. Thomas. The trees in one case were raised from seed imported from Mexico seven years ago, and in the other the seeds were imported from Costa Rica about ten years ago.

I submitted leaves of these trees to Professor Pittier and he has provisionally identified the Mexican tree as *C. elastica*, and the Costa Rican tree as *C. costaricana*.

When the trees flower and fruit in a few months' time I hope to secure complete botanical material to be sent to Professor Pittier for authentic determination, but it would appear from our present information that we have at least three species in Jamaica.

I may mention that Mr. David Fairchild, the Agricultural Explorer in Charge of the Bureau of Plant Industry of the U. S. Department of Agriculture, has made arrangements to send us during the coming fruiting season, a small supply of seed of every reputed rubber-producing species of Castilloa for trial in Jamaica.

11.—YIELDS OF RUBBER FROM CASTILLOA TREES.

A.—MR. W. CRADWICK, *Agricultural Instructor.*

1. Castilloa trees planted at Retreat estate in Portland five years ago have now an average girth of 29 inches at 2 feet from ground. The height is 25 to 35 feet. These trees were planted in Banana land at a spacing of 14 feet.

2. At Rosend in St. Mary, the following measurements were obtained.

	Variety.	Age.	Girth at 3 feet.
(a)	Manihot Glaziovii	4 years	26½ inches,
(b)	Castilloa guatemalensis	3 years	22 ,,
(c)	Hevea Brasiliensis	3 years	9-12½ ,,

Photographs of (a) and (b) are given in plates 66 and 65. We are indebted to the Attorney, Mr. Henry Cork, for permission to reproduce these photographs.

3. At Burlington in Portland the oldest Castilloa tree (obtained from Castleton in 1887 and estimated to be 23 years old) was tapped on December 23rd, and gave 4lb. 6. oz. of crude rubber and 7 oz. of scrap, total 4lb. 13 oz. in one tapping. This is the highest yield yet recorded in Jamaica.

This tree was tapped in September and October, 1907, and gave 22 ozs. rubber in three tappings extending over three weeks.

It is growing on poor hilly land unsuitable for bananas, and now has a girth of 86 inches showing, a gain of 6 inches in a period of 3½ years.

At the last tapping the latex ran freely and a splendid yield was obtained. The leaves from this tree have been identified by Mr. Harris as those of the species *guatemalensis*, originally introduced through Castleton Gardens.

B.—MR. J. BRISCOE, *Agricultural Instructor.*

(1) Two large Castilloa trees at Castleton age 25 years gave 4 lbs. of rubber in 5 tappings or 2 lb. per tree (Species *Guatemalensis*).

(2) Four trees in St. Thomas-in-the-Vale, aged 10 years, averaged 3 ozs. rubber each at the first tapping (Species *guatemalensis*).

(3) Three trees at Linstead, aged 10 years, averaged 2 ozs. rubber each at the first tapping, two of these girthed 50 inches, and the others, 37 inches. (Species *guatemalensis.*)

(4) At Koningsberg in St. Mary,
No. 1, 8 years, 48 inches in girth gave 11 oz.
No. 2, 12 years, 72 inches in girth, gave 2 lb.
No. 3, 12 years, 84 inches in girth, gave 1 lb. 11 ozs.

(Species *guatemalensis.*)

St. Thomas—

(*a*) *Castilloa elastica* from Mexican seed, trees 7 years old, 36 inches in girth, gave 9 ozs. rubber.

(*b*) *Castilloa costaricana*, from Costa Rican seed, trees 10 years old, 36 inches girth, gave 7 ozs. rubber.

Linstead, St. Catherine—

Species, *Castilloa guatemalensis.*

(*a*) Three 10 years old trees, averaged 2½ ozs. rubber each.

(*b*) Three 10 years old trees, averaged 2½ ozs. rubber each.

St. Andrew—

Species, *Castilloa guatemalensis.*

Belle Vue, Red Hills, tree aged about 24 years, girth 62 inches, 1st tapping gave 1 lb. 9 ozs., 2nd tapping a month later, gave 1 lb. 8 ozs.—Total 3 lb. 1 oz.

C.—MR. L. WATES,

Agricultural Instructor: for Portland and St. Thomas.

In Portland, 76 trees varying from 8 to 14 years have been tapped. The yields have varied a good deal. One tree 14 years old and 65 inches girth, gave 25½ ozs. of rubber at the first tapping. The tree was tapped every month but after the third tapping gave no latex. After a rest of 4 months the tree gave a further 7 ozs. and two months later 5 ounces more, making a total yield of 2 lb. 9 ozs. rubber from this tree.

Mr. Wates concludes from his experiments that 3 or 4 tappings a year will be the maximum desirable and that on suitable soil in Portland, trees of ten years should girth 45 inches and yield from four to five ounces of rubber for the first tapping.

He considers from these observations that a yield of 225 lb. of rubber per acre per annum after the ninth year can be reasonably expected from Castilloa plantations in the Parish.

111. TAPPING.

The demonstrations of tapping on some 7 years old trees at Hope showed the great convenience and utility of the new "Thompson tool" for tapping Castilloa trees.

We can recommend this implement as the best tool yet tested in Jamaica for tapping Castilloa rubber trees.

H. H. C.

OILS AND FATS.

CAMPHOR OIL.

Semi-Annual Report of Schimmel & Co. April, 1911.

(FRITZSCHE BROTHERS.)

During the past six months no noteworthy alterations have occurred in the Japanese camphor oil market. Only a few large parcels have been brought forward since we covered our requirements for a long time ahead, and these have mostly found buyers at full prices in the United States. Light and heavy camphor oil, the by-products of our safrol manufacture, have enjoyed a very active demand, because they have recently been used chiefly as substitutes for turpentine oil or in the manufacture of turpentine substitutes, the price of genuine turpentine oil having risen to a figure never known before. We have repeatedly been under the necessity of advancing the prices of our oils, and the fact that they still continue to be in brisk request shows that for the present there is no prospect whatever of any decline in the quotations. Our special quality light camphor oil, known as "A," possesses about the following constants: d_{15° 0,860 to 0,870, b. p. 170 to 182°, flashpoint at 763 mm. press. about 53°. This quality has at intervals been in such request that our works were scarcely able to keep pace with the demand. The working up of crude camphor oil has attained so great an importance in our establishment that, although our plant is on the largest imaginable scale, we are only able to keep up with orders by working night-shifts.

According to a Japanese source *, the net profits of the Formosan Monopoly Bureau have increased in the year 1909 to 2½ million Yen (= over £250 000,) while the results for 1910 are expected to be still better. Camphor from Southern China, of which the price at the time of the Report (August 1910) was 140/-as compared with 145/-for quality B and 140/ for quality BB of the Japanese article, was in poor demand, while apparently the synthetic article had disappeared from the market.

According to further reports in the same paper a special commissioner of the American firms interested in the camphor trade, Mr. Anderson, has personally entered a protest with the Japanese Government against the irregularity in the sales of refined camphor to the United States. A journey to Formosa, undertaken by Mr. Anderson for the purpose of collecting information, showed that a certain Japanese firm which had a concession for the preparation of crude camphor only, was unlawfully engaged in refining camphor. This led the American to enter a fresh protest with the Japanese Ministry of Finance, accompanied by a threat of

* Oriental Physician and Druggist, Yokohama 4 (1910), No. 36, p. 6.

diplomatic representations. Similar complaints are said to have been made of the firm in question some years ago. An American trade-paper † devotes a lengthy report to the subject, from which we gather that the firm concerned (which is here also mentioned by name) has been preferred by the Government for supplies of crude camphor at the expense of other Japanese refiners and that the firm is said to contemplate monopolising the trade is refined camphor for itself, or at any rate for Japanese houses. It would be impossible for the American refiners to take any effective measures against such a proceeding, either by fiscal or by diplomatic means.

A report by Dr. Müller, interpreter at the Imperial German Consulate-General at Yokohama ‡, contains detailed information on Japanese camphor, dealing with the production, export and other commercial matters relating to the drug. These particulars amplify in many respects the information already given in our Reports, for which reason we reproduce them textually below:

THE EXPORTS OF THE PAST 3 YEARS HAVE BEEN AS FOLLOWS:—

	1907. Quantity Piculs.	1907. Value Yen.	1908. Quantity Piculs.	1908. Value Yen.	1909. Quantity Piculs.	1909. Value Yen.
Old Japan ...	30,576	5,026,858	18,075	2,063,410	40,507	3,469,398
Formosa ...	22,648	2,619,143	16,710	1,710,493	50,030	4,377,816
Total ...	53,224	7,646,001	34,785	3,773,903	90,537	7,847,214

Two points at once strike us in considering these figures.

1. The great difference between the export values of the years 1907 and 1909 in proportion to the quantity exported, indicating a serious depreciation of the product.
2. The considerable increase, amounting to over 100 per cent. of the exports during the year under review as compared with the preceding year.

The following explanation of these two factors may be given:—

For many years the Japanese Monopoly Bureau believed that it was possible to control the world's market in camphor and to dictate prices according to its pleasure. The Bureau therefore advanced its average sale price from 120 yen per picul in the year 1903, to an average of from 150 to 160 yen (the highest limit) in the years 1906 and 1907, while at the same time it promoted most assiduously the collection of camphor, partly by increasing the purchase prices paid to the producers, partly by the laying down of new plantations of camphor trees. After the revival of the Chinese production and the appearance of artificial camphor, however, the demand for Japanese camphor underwent a considerable decline, and the Japanese Government, after suspending its sales for a long time, was finally brought to the conviction that the measures it had so far taken were a failure. It therefore decided upon repeated reductions in price, the last of which was made in September, 1908, with the object of thereby getting rid of its steadily accummulating stocks. Since that time the prices have been as follows:—

a) In Japan. 80 yen per picul for improved B. camphor, and 78 yen per picul for B. camphor.

b) Abroad. 140/- per cwt. for improved B. camphor, and 135/- per cwt. for B. camphor. Taken in London or Hamburg.

For the above reasons the high figures relating to the year under review do not warrant the conclusion that there has been an increase in production, in fact they are in the main only the consequences of the severe reductions in price and of the sale of the accumulated stocks which has been made possible by these reductions. In Old Japan the production has even declined in consequence of the lowering, in the year 1909, of the prices paid to the producers.

With regard to the camphor exported from Old Japan (Kobe), it should be noted that this is not all of Japanese origin, but that it includes, in addition to camphor produced in Japan, considerable quantities of camphor which has been separated out from oil produced in Formosa. The exports of camphor oil from Formosa to Japan in the year under review amounted to 36,394 piculs, from which about 18,000 piculs of camphor were prepared.

† Oil, Paint and Drug Reporter 78 (1910), Vo. 10, p. 7.

‡ Deutschea Hand. Arach. 1911, Februory Number, p. 137.

The subjoined table shows the conditions of production during the past few years, *i.e.*, during the administrative and not the calendar years.

	1907. Piculs.	1908. Piculs.	1909. Piculs.
Formosa:			
1. Camphor A ...	—	314	—
2. Improved B ...	17,796	31,040	31,007
3. Camphor B ...	28,879	16,594	29,342
Total ...	46,675	47,948	60,349
Japan:			
1. Improved B ...	4,818	6,552	8,139
2. Camphor B ...	4,338	5,457	3455
Total ...	9,156	12,009	11,504
Grand Total ...	55,831	59,957	71,943

B is crude camphor; improved B (BB) is crude camphor which has been purified to 97% by distillation. A is pressed BB and is only prepared in Formosa.

The estimated production during the administrative year 1910 is for Formosa 58,090 piculs of camphor and 67,300 piculs camphor oil; therefore, assuming that 30,000 piculs of camphor will be recovered from the oil, the total output of Formosa would amount to 88,000 piculs.

This estimate is based upon the assumption that the advance in prices which has taken place on the European market since the end of last year, will again induce the producers to prepare sufficient camphor to satisfy the largest possible demand. But whether this high estimate will, in fact, be realised appears for the present all the more doubtful, because in spite of the abundance of camphor forests in the island, a lack of trees is already making itself felt in those districts where order has been established, so much so, that occasionally it is necessary to distil old branches and roots. In any case, however, the production in Formosa during the administrative year shows an increase over the preceding year, whereas in Japan, in spite of every endeavour, it has been impossible to increase the production to the desired extent, notwithstanding the fact that as the remaining supplies of trees dwindled, the distilling plants were not only frequently removed, but young trees and roots also were worked up.

As regards the new plantations which are being laid down energetically both in Old Japan and in Formosa, it is to be observed that plants raised from seed cannot be worked up until they are at least 15 years old, and also that the experiments of growing camphor trees from roots or slips have been a failure both in Formosa and in Japan.

Owing to the serious reduction in price, the revenues of the Monopoly have fallen off greatly, and in Old Japan, where the average price of production of the camphor during the past three years has been about 90 yen per picul, the Monopoly has actually been working at a loss. But in Formosa also, although the cost prices there are lower (58 to 60 yen per picul) it is doubtful whether, under the present conditions, the Monopoly can cover its expenses, taking into account the very onerous exportation and freight charges, as well as the costly military operations against the ravages which have been undertaken for the purpose of opening up new camphor forests.

Newspaper reports state that for the reasons above mentioned the firm of Mitsui and Co. which, as is well known, at present controls the marketing of the camphor Monopoly, advised the Japanese Government some time ago to abolish the State Monopoly, because it would otherwise be impossible to maintain the article against the competition of the Chinese and the artificial products. It is, however, to be expected that the Government, being loth to abandon a Monopoly which has been established on a large scale and with a considerable staff, will for the present concentrate its efforts upon continuing the struggle against the synthetic camphor, even at a loss, at any rate so long as there are grounds for hope that it can dictate prices which will make the manufacture of the synthetic product unprofitable. That the Japanese Government assumes for certain that this is the case at the present time, may be inferred from the statement of the Director of the Monopoly Bureau that "natural camphor was not threatened by any danger so long as no new manufacturing processes were discovered which would make it possible to produce synthetic camphor at a lower cost than the present."

The table below shows the quantities of camphor exported during the administrative year to the various countries of destination :—

EXPORTS FROM

	Formosa-Kelung. Quantity: Picul.	Formosa-Kelung. Value: Yen.	Old Japan (Kobe). Quantity: Picul.	Old Japan (Kobe). Value: Yen.	Formosa-Japan. Quantity: Picul.	Formosa-Japan. Value: Yen.
Germany ...	18,496	1,674,340	6,389	545,574	24,885	2,219,923
U. S. A. ...	14,313	1,064,279	10,081	824,646	24,394	1,888,925
France ...	10,119	969,349	6,169	518,516	16,288	1;487,865
U. Kingdom ...	5,680	538,953	10,081	890,413	15,761	1,429,366
British India ...	1,422	130,895	4,983	498,312	6,405	629,207
Hong Kong ...	—	—	996	108,066	996	108,066
Total Including other countries ...	50,030	4,377,818	40,507	3,469,398	90,537	7,847,216

It is to be noted that the above statistics, supplied by the Japanese and Formosan Customs, for the first time represent approximately the actual condition of things, inasmuch as the proportion of the exports sent to Germany, the principal consumer of the product in question, appear to have been accurately stated at 25,000 piculs, representing a value of 2 million yens. In former years, when camphor shipped to Europe was as a rule declared as for export to Hong Kong, the statistics referring to the division of the exports were in the highest degree misleading.

Another matter which merits attention is the pronounced increase in the exports to France, which in the year under review took 16,288 piculs, value 1,486,864 yen, against only 4,577 piculs, value 503,348 yen in the preceding year.

The shipments of camphor from Formosa have again declined considerably in the first half of the current year, as is shown by the following figures :—

First half year 1910	...	18,324 piculs*
,, ,, ,, 1909	...	30,874 ,,

The reason of this decline is that the camphor stocks of the year 1908 have in the meantime been cleared.

It is well known that camphor is also refined in Japan ; but it should be pointed out that this branch of manufacture has not been undertaken by the Monopoly Bureau but only by private persons, to whom the Government cedes at definite prices a certain quantity of crude camphor fixed in advance. At present there are 7 private refineries, of which 4 are at Kobe, 2 at Osaka and 1 at Taipeh. The total quantity of refined camphor produced in the administrative year 1909 amounted to 9,442 piculs in Formosa, and 7,270 piculs in Old Japan.

During the same period the Japanese Government supplied the following quantities of raw material :—

1. To the refineries in Formosa .. 9,000 Picul.
2. To the refineries in Old Japan 7,454 ,,

* To this should be added 12,998 piculs of camphor prepared from Formosan oil and exported from Kobe.

The price of refined camphor per 100 lbs. (English) during the year 1909 and in the first 7 months of 1910 was as follows :—

1909.			1909.		
January	...	65 Yen.	November	...	70 Yen.
February	...	65 ,,	December	...	71 ,,
March	...	66 ,,	1910	...	
April	...	67 ,,	January	...	70½ ,,
May	...	68 ,,	February	...	70 ,,
June	...	68 ,,	March	...	70 ,,
July	...	68½ ,,	April	...	69½ ,,
August	...	68½ ,,	May	...	68½ ,,
September	...	69 ,,	June	...	68½ ,,
October	...	70 ,,	July	...	70 ,,

As the Monopoly covers only the preparation and sale of crude camphor, the quotations of refined camphor are not subject to fixation by the Government. This fact is said to have been utilised by the Japanese firm of Suzuki Shoten in Kobe (in whose hands the exports of refined camphor are chiefly concentrated) for the purpose of cutting the prices to such an extent that according to newspaper statements the Association of American Camphor Refiners has recently threatened to boycot the crude camphor from Japan and Formosa unless the Monopoly put an end to this practice. It is reported that the Japanese Ministry of Finance is at the present moment engaged in making a thorough enquiry into the subject. *

The exports of camphor oil, *i.e.*, of the red and white oil which remains behind in the process of separating the camphor from the camphor oil, were as follows :—

	Quantity ; Piculs.	Value : Yen
1909 ...	12,727	230,310
1908 ...	12,599	212,947

Of these amounts, Germany in the year under review only received 1402 Piculs, of a value of 21,944 Yen.

The production of camphor in China is steadily dwindling. In amplification of previous notes on the subject† we may

* Compare the statements on page 32 of the present Report.

† Report April 1908, 21 ; April 1910, 26 ; October 1910, 26.

state that according to recent German Consular Reports *, the total output has declined to 9579 piculs, of a value of 680,827 Haikwan Taels of which 4889 piculs were exported via Shanghai and 3945 via Foochow and Amoy. For the year 1910 only the figures of the ports of shipment are yet known. Shanghai exported 4410 piculs, while Foochow shipped 981 piculs to Hong Kong and Amoy, 21 piculs to Hong Kong and 3 piculs to Singapore. It is not probable that there will be an increase in the exports so long as the price does not advance above the parity of 145/ per cwt. cif. London, which corresponds to a cost price of 60 H. T. at Shanghai.

Upon comparing the statistics of exports from Shanghai (Central China), with those of Foochow and Amoy (Southern China) it will be found that for the past four years the shipments from Shanghai have remained almost unchanged, while those from the two other ports have shrunk to barely more than one-twentieth of the old figures. The reason of this is that in the South the supplies of trees have been recklessly wasted, but not so in Central China, where, on the contrary, large reserves of trees are left almost untouched, extending far into the interior towards the province of Szechuan. If the price of camphor should go up, these supplies may possibly be utilised also, provided by then the Chinese have learned more rational and economic methods of production.

Under the title "Camphor Industry in Foreign Countries" the Bureau of Manufactures of the American Department of Commerce and Labour has published a comprehensive Report by several U. S. Consuls †. The contents are indicated by the title. The several reports so far as regards natural camphor are from Japan (Yokohama and Kobe), Formosa (Tamsui) and Ceylon (Colombo). The report from Borneo deals almost exclusively with the conditions relating to Borneo. As becomes the leading position of Germany in the domain of synthetic camphor, the report on this article is by the U.S. Consul at Hamburg. The reports contain detailed information on the mode of preparation and the conditions of trade in every producing district of any importance, but as these matters have already repeatedly been dealt with in our Reports we refrain from entering into further particulars.

* Nachrichten f. Handel u. Industrie 1911, No. 39, p. 4 and No. 31, p. 4.

† Special Consular Reports Vol. XLIII, Part. III. Washington 1910.

According to a communication by Thoms* to the German Colonial Congress, held at Berlin from October 6th to 8th, 1910, the Committee for the Economic Development of the German Colonies has offered a prize of 3000 M. (£ 150, $ 750) for the first 5 kilos of camphor produced in a German Colony.

We have referred on a previous occasion † to Cayla's detailed statements on the occurrence of a true and a spurious camphor tree in Indo-China. At that time, Lan identified the spurious tree as *Cinnamomum zeylanicum*, Br. Cayla reports ‡ that Dubard has lately botanically examined two parcels consisting of parts of plants from both species of trees sent to him by the Agricultural Department of Indo-China, and that he (Dubard) has proved beyond doubt that the specimen marked "spurious camphor tree" was as a matter of fact derived from *Cinnamomum Camphora*, while the specimen marked "true camphor tree" consisted of parts *Cinnamomum cecidodaphne* var. *uniflora*. There was no room for any error so far as Dubard's identification was concerned. Lemarie (continues Cayla) observes in connection with the above that the differentiation between the true and the spurious camphor tree was merely a personal distinction made by Crevost, by whom also the two specimens in question were forwarded. According to Dubard the fact remains that two species of *Cinnamomum* occur in Indo-China, both of which are designated there as "camphor trees" and both of which according to Meissner, contain camphor. Lan passes without remark the identification of one of his specimens as *C. cecidodaphne* and continues to maintain that his spurious camphor tree is identical with *C. zeylanicum*, although the occurrence of the cinnamon trees in Indo-China is not referred to either in the previously existing literature on the subject or in the recent work of Perrot and Eberhardt. It would indeed be remarkable if the Annamese, who surely must have stripped the tree of its bark at some time or other, had named the tree from its negative instead of its positive properties. The Japanese, too, call their camphor tree the "spurious cinnamon tree of Japan." In any case the occurrence of *Cinnamomum zeylanicum* in Indo-China would be a new fact and well worth further investigation.

* Chem. Ztg. 34 (1910), 1237.

† Report April, 1908, 23.

‡ Journ. d'Agriculture tropicale 10 (1910), 252.

On a previous occasion* we have given full details (taken from an article by Cayla) on the experiments by Eaton and Campbell† in the introduction of the cultivation of the camphor tree in the Federated Malay States. We therefore refer to the original publication for details, especially in respect of the plantations and the distilling-practice.

Apparently the Japanese have been seriously alarmed‡ by the report that it is intended to lay down extensive camphor plantations in the "Southern States of America" (probably meaning the Southern United) and fears are again entertained as to the continuance of the Japanese Monopoly. But, as if to dissipate these fears, it is also reported that the two new Japanese celluloid works would be able, in the event of their favourable further development, to absorb the entire Japanese camphor production. It is to be added, however, that the informant from whom the American paper quotes this news is himself doubtful whether the works in question will be able permanently to carry on their business at a profit.

R. T. Baker§ the well-known Botanist, has read a paper at Sydney on the native camphor trees of Australia. According to Baker the species of the genus *Cinnamomum* which have so far been recorded in Australia, are endemic, and not identical with any Indian species, as maintained by some systematists. Baker not only founds his classification upon morphological indications, but also on the anatomy of the bark and on the chemistry of the timber and of the oils obtained from the leaves and bark. Baker has found that similar to a plan advanced by himself and Smith ‖ many years ago for the different *Eucalyptus* species, a certain agreement exists between the venation of the leaves and the chemical constitution of the essential oil of the leaves. This fact enables the oil-distiller, by the simple experiment of observing the disposition of the veins, to ascertain what class of oil can be obtained from them, and it is therefore of considerable practical importance, especially since the phellandrene oils of the eucalyptus have recently found employment on a considerable scale in the treatment of refractory ores*. The presence of phellandrene in oil from the leaves is indicated by the very oblique lateral venation of the leaf. It has been ascertained that of the *Cinnamomum* species which have so far been investigated in Europe and Australia those which contain camphor have penniveined leaves, while leaves with a tri-nerved venation yield a camphor-free oil. The importance of this difference is evident. In its *Cinnamomum* trees Australia possesses a native source of camphor which as yet remains unexploited. From the leaves of *C. Oliveria* high camphor-yield has been obtained, and camphor is also present in the wood, but the oil distilled from the bark still awaits examination. *C. Laubatii*, a species little known at present, and a few other species also appear to be camphoraceous. As a result of the investigation, so far as it has gone, *Cinnamomum* trees have been planted on the North Coast with the object of utilising them for oil and camphor-production.

The discovery of camphor as a constituent of an Australian oil was made by M. Scott in the course of the examination of a sassafras oil from the Colony of Victoria.

* Preliminary Notes on the Preparation of Camphor in the Federated Malay States Agricultural Bulletin of the S. and F.M.S., August 1909. From a reprint kindly sent to us.

† Report April 1910, 27.

‡ Oriental Physician and Druggist 4 (1910), No. 36 p. 7.

§ From a private communication kindly made to us by the Author.

‖ Comp. the report April 1902, 41.

* Comp. the present Report, p. 39.

CITRONELLA OIL.

SEMI-ANNUAL REPORT OF SCHIMMEL & CO.

(*Fritzsche Brothers*, London and New York, April, 1911.)

Since our October report the prices of Ceylon citronella oil have slowly but steadily declined, until towards the end of January they reached their lowest level at 10½d. cif. London; since then they have remained unchanged with a rather lifeless tendency.

The shipments from Galle during the past year again established a record, the figures being as follows:—

	1,747,934 lbs.	in	1910,
Compared with	1,512,034 ,,	,,	1909,
,, ,,	1,276,965 ,,	,,	1908.

In 1910 therefore there has again been an increase of over 235,000 lbs. Although this fact might sufficiently explain the quiet state of the article, we may nevertheless mention that the exports from 1st January to 20th February 1911 only reached 176,430 lbs., compared with 359,377 lbs. in the same period of 1910. We have therefore to reckon with a decreased export of about 183,000 lbs. in the first six weeks of 1911, although it

may be assumed that this temporary falling off will be made good in the course of the next few months. According to the information in our possession, the decline is apparently due to the fact that the New York market shows a tendency to hold aloof, for the shipments to European ports show no noteworthy differences.

Java citronella oil has also been offered plentifully, and although the preparation of this highly esteemed quality has for some considerable time been concentrated in the hands of a few producers, whose principal endeavour it is to prevent over production at all costs, they have nevertheless found it necessary to show more pliability in their demands than has been the case in recent years. We are regularly in receipt of considerable supplies of a quality which answers the highest requirements.

As stated at some length in our last two Reports*, attempts are being made by certain interested persons in England to supplement, or rather to replace, the solubility test (Schimmel's test) of citronella oil, which is now the customary commercial test and which was introduced by us, by a "geraniol test," under the plea that our test does not afford sufficient gurantee of a pure oil. The geraniol test consists in determining the acetylatable constituents of oil (total-geraniol, geraniol + citronellal) and it has been proposed in one quarter that the market price of Ceylon-citronella oil should be based simply upon its total-geraniol content, and in another that the oil should be required to show a minimum content of 60% or should be divided, according to its total-geraniol content, into three classes, containing respectively from 56 to 60%, 60 to 64% and 64 to 68%, and valued accordingly. The question has lately been debated† with renewed animation because we had taken the liberty of writing a letter to an English Journal‡ pointing out the difficulties which stand in the way of the practical introduction of such a test in Ceylon. The fact that in London this attitude of ours has been made the occasion of charging us with inconsistency shows that we have been completely misunderstood, for we have never asserted that the geraniol test is not the best method of valuing citronella oil. But the conviction that the value of citronella oil depends in the first place upon its total-geraniol content does not blind us to the difficulties which would probably accrue from the general introduction of such a standard into the Ceylon citronella oil trade, for the reason that so far as our information goes, the chemically-trained assistance required for the purpose is wanting in the Island. If this difficulty could be overcome we should certainly not be the last to rejoice, for it would be entirely in accord with our desire if this oil also could be tested and sold on strict chemical principles. And we should regard it as the best solution of the problem if the Government of Ceylon were able to arrange for the official control of the distillation and sale of citronella oil, and for the examination by Government-chemists of the quality and purity of the oil destined for export, because all the existing malpractices would thus be put an end to if necessary. But these are pious wishes which in all probability are hardly realisable, for, as already stated, there are not enough trained chemists in the Island to carry out the tests, quite apart from the expense which the examination would entail and the consequent increased price of the oil. This is also the opinion generally held by the large exporters of citronella oil in Ceylon* who surely are best acquainted with the existing conditions, and most able to form a correct judgment. In answer to this it is said that it has been possible to arrange that cassia oil is to-day sold everywhere according to its cinnamic aldehyde content, and lavender oil according to its linalyl acetate content; but these comparisons do not hold good, because every layman can be taught in the shortest possible time to carry out a cinnamic aldehyde estimation, while the ester estimation of lavender oil does not meet with any difficulties in the south of France, where there are plenty of chemists or pharmacists who know how to carry out properly the saponification method. But if our information is correct, the crucial point in the whole question of the geraniol test is just this, that Ceylon does not possess a sufficient number of trained chemists or pharmacists to carry out the necessary examinations, and that the layman can be of no use in this particular matter because he does not possess the knowledge required for chemical work of this nature. Besides this, it is necessary to lay special stress upon the fact that in determination of the total-geraniol content in citronella oil it is particularly necessary always to work under the same conditions, if comparable results

* Report April 1910, 39; October 1910, 37.

† Chemist and Druggist 77 (1910), 895, 912; Perfume and Essent. Oil Record 2 (1911), 3.

‡ Chemist and Druggist 77 (1910), 875.

* Chemist and Druggist 77 (1910), 811.

are to be obtained. In reading through the articles which have been published on the geraniol test, we came among others, upon a prescription* which referred to the writer's "own method" to the complete neglect of all the newer investigations, especially those relating to the acetylation of citronella oil†. At the present time in particular this is much to be regretted and show how well-founded is our fear that the determination of geraniol will not always be carried out accurately. We wish to point out again that in the case of citronella oil in particular it is necessary to adhere strictly to the prescribed method, if the results are to be indicative of the actual total-geraniol content and are to be mutually comparable‡,

For this purpose we give below a method by which we work in our own laboratory, and which according to our experience produces the best result with mixtures of known geraniol and citronella content.

10 cc. each of citronella oil and acetic anhydride with 2 g. anhydrous sodium acetate and a few fragments of porous plate (in order to prevent the liquid from bumping) are kept boiling at an equal temperature in an acetylation flask for 2 hours on the sand bath. When the mixture has cooled, a little water is added to the contents of the flask and the whole is heated for a quarter of an hour upon the water bath under frequent shaking in order to decompose the excess of acetic anhydride. The oil is then separated in a separating funnel and washed with water or, better still, with a solution of common salt until it gives a neutral reaction. Of the acetylated oil dried with anhydrous sulphate of sodium, 1. 5 to 2 g. is saponified with 20 cc. of seminormal potash-liquor, any free acid which may have been present having been previously carefully neutralised. The time of saponification must be at least one hour.

The reason, therefore, why we are not so enthusiastic about the geraniol test as those interested in the subject in England. and why, for the present, and so far as regards the trade in Ceylon itself, we continue to hold to a test for Ceylon citronella oil which can be carried out by anybody without special knowledge or trouble, is not to be sought in opposition to the test itself, but rather in the difficulties of carrying it out. The method known as "Schimmel' test" to which we adhere may again be briefly repeated here in its original form. By this test citronella oil must give a clear solution with 1 to 2 vols. 80° C, and this solution must remain clear or may at most show a slight opalescence upon the addition of up to 10 vols. 80% alcohol. Even after being left to stand for several hours, no drops of oil may separate out from the solution. As it has been shown in the course of years that oils which have been adulterated to a moderate extent also stand this test, we proposed some considerable time ago* an "increased test" under which an oil after being diluted with 5 per cent of Russian petroleum must also answer the above test. We have been able to convince ourselves both in our laboratory here as well as by experiments on the spot, that really pure Ceylon citronella oils are able to stand this "increased test," and that contradictory statements which have been circulated from England are without any foundation. Further experiments have gone so far as to show that pure Ceylon citronella oil will answer the test even when instead of being diluted with Russian petroleum it is diluted with 5 per cent of the rather more sparingly soluble American petroleum. Where, therefore, Russian petroleum is not available American may be used. In that case, however, the opalescence is a little more pronounced, but here, too, no drops of oil may separate out from a solution of 1: 10. When the 10 vols. of alcohol is being added the glass cylinder should only be moderately tilted, because otherwise oil which may have separated out is so finely suspended as to make observation very difficult,

If our proposals had long ago received the attention which they merit, and if Schimmel's "increased test" had been generally introduced into commerce, the present discussion would be wholly superfluous, for in that case there would no longer have been any complaint of bad quality, seeing that ready solubility also affords a certain guarantee for a sufficient geraniol-content. To the objection that ways and means would be found in Ceylon of so preparing adulterated oils that they would pass the "increased test," we may answer that the same may be said with exactly the same amount of justification of the geraniol test.

We may add that in the meantime we have grudged no expense or trouble to obtain really unadulterated citronella oil from Ceylon, and we are glad to be able to inform our clients that we are now in possession of such an oil, which

* Chemist and Druggist 77 (1910), 896.

† Report April 1909, 36; April 1910, 154.

‡ Comp. Report April 1910, 154,

* Report April 1904, 32.

answers every test, including of course Schimmel's "increased test," and which possesses a geraniol-content ranging from 57 to 61 per cent according to the drums. The price of this newly-introduced variety of oil, the appearance of which will probably be received with general satisfaction, is about 10 per cent in excess of the ordinary quality.

In our October Report of 1909* we referred to experiments which had been made by J. F. Jowitt of Bandarawela, Ceylon, in the cultivation and distillation of *Andropogon* (Cymbopogon) grasses. The oils obtained by Jowitt have since been examined at the Imperial Institute in London by Samuel S. Pickles, the botanical origin of the corresponding grasses being at the same time again carefully determined by Stapf. The result of this examination,† which was published at the end of last year, is especially interesting because, in addition to the familiar citronella and lemon-grass-oils, the oils from the wild mana grass‡ as well as from delft-grass, are here described for the first time. Up to the present nothing was known concerning the properties of these oils.

Of mana-grass, which probably constitutes the mother-plant of citronella-grass, Stapf distinguishes two varieties: *Cymbopogon Nardus* var. *Linnæi* (typicus) and C. *Nardus* var. *confertiflorus.* In Ceylon the natives differentiate still further, having a series of names for each slightly different plant (compare the table on p. 10), but Stapf traces all these back to the two varieties mentioned. The oils of these two grasses have no attributes which are characteristic for each particular variety; on the contrary, in both cases the same range of differences in yield and properties of the oils distilled at different times is observable, and this is probably correlated to the mode of cultivation and manuring, as well as to the season when the oil was distilled.

The yields varied from 0·06 to 0·45 per cent.; they were at their lowest in grass distilled in May, the succeeding months, generally speaking, producing a larger yield. All the oils ranged in colour from bright to deep yellow, and with few exceptions they had an agreeable citronella-like odour, although mostly a little acrid. They gave a clear solution with 1 to 1·4 vols. of 80 per cent. alcohol. When 10 volumes of the solvent was added the solution showed a more or less marked opalescence and in two cases a slight turbidity; only in one instance (No. 14) did the solution remain clear even when diluted. In addition to the total-geraniol content (geraniol citronella) the geraniol content was estimated separately by the phthalic anhydride method*, the citronella-content being calculated from the difference. This test showed that the relation of geraniol to citronellal varied as irregularly in these two grass oils as did the other properties, the variation being similar in each case. In some, such as the *Lenabatu* oils, geraniol predominated; in others, as for instance, the *Maha-Pengiri* oils, citronellal. These and all other details are best seen in the table on the next page.

Setting aside samples 11 and 12, the constants of the two oil varieties lie within the following limits:—

	Oil of C. *Nardus* var. *Linnaei.*	Oil of C. *Nardus* var. *Confertiflorus.*
$d_{15°}$ ...	0·894 to 0·926	0·900 to 0·929
a_D ...	+4°54 to—6°32′	+ 12°12′ to—2°11′
Total gerniol...	43·5 to 64·7%	39·1 to 64·2%.

As already stated above, there is therefore no particular difference between the oils of the two mana-grasses. Samples 11 and 12 show greater deviations; they attract attention because of their high sp. gr., their very pronounced dextrorotation and their low total-geraniol content. These samples, however, are abnormal, and they have therefore been left out of account in drawing up the limits of value, because, according to Stapf, the corresponding grasses are to be regarded as degenerate forms.

None of these mana grasses is thought to possess any commercial interest. Apart from the fact that the oil-yield is generally small, the oils themselves are of such poor quality that they cannot compete with the citronella oils of commerce. We cannot form an opinion on the question how far this judgment is correct, not having had an opportunity yet of handling oils of this kind.

From Lenabatu-grass, now called *Cymbopogon Nardus*, Rendle, *lenabatu*, Stapf, Jowitt prepared four oils which behaved like the ordinary commercial oils. The yield varied from 0·42 to 0·56% and the constants lay within the following limits: $d_{15°}$ 0·913

* Report, October, 1909, 42.

† Cymbopogon Grass Oils in Ceylon. Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon, Vol. V., No. 12, November, 1910, 145. Also Comp. Bull. Imp. Inst. 8 [1910], 144.

‡ Comp. Report April, 1907, 32, 33. Also see Report, October, 1909, 42.

* Report, October, 1899, 24.

to 0·917 α_D—11°53 to—14°16, total geraniol 57·8 to 62·1%. The citronellal content was from 24·4 to 33·6%. All the four samples gave a clear solution with 1 vol. of 80% alcohol, the solution becoming opalescent upon the addition of 10 vols. of the solvent.

Of three Maha-pengiri oils from Cymbopogon Winterianus, Jowitt* the highest yield, 0·77%, was obtained from a grass distilled in November, two samples ofgrass distilled in June and August only yielding 0·59% each. The November oil also gave the highest total-geraniol content (84·8% as compared with 79 and 83,5% for the two others); for the rest all the three oils agreed with Java citronella oil.

No.	Patent Plant.		d_{15}	α_D	Total Alcohol. %	Geraniol. %	Citro-nellal. %
	Botanical Name according to Stapf's (determination.)	Native Name.					
1	*C. Nardus*, Rendle var. Linnæi, Stapf. (Typicus.)	Maha-Naran Pengiri	0·920	—307'	51·6	27·6	24·0
2	,,	,,	0·905	—6°32'	63·2	38·4	24·8
3	,,	,,	0·912	+3°22'	57·2	36·2	21·0
4	,,	Heen-Naran Pengiri	0·913	+2°35'	43·5	24·6	18·9
5	,,	,,	0·894	—3°20'	47·7	25·8	21·9
6	,,	,,	0·909	+2°6'	53·5	30·0	23·5
7	,,	Light-leaved Mana	0·909	+4°54'	56·5	38·6	17·9
8	,,	,,	0·908	+3°30'	64·0	30·2	33·8
9	,,	Small-leaved Mana	0·906	+3°7'	57·0	34·4	22·6
10	,,	,,	0·909	+3°20'	56·3	36·5	19·8
11	,,	Sour Mana	0·935	+16°	35·3	16·3	19·0
12	,,	,,	0·967	+15°50'	26·9	6·3	20 6
13	,,	Very broad-leaved Mana	0·926	+1°31'	48·7	25·8	22·9
14	,,	,,	0·906	—0°24'	64·7	36·5	28·2
15	,,	Given as "Maha-Pengiri" but probably "Mana"	0·912	—1°38'	48·6	25·5	23·1
16	,,	,,	0·909	+2°18'	56·4	35·8	20·6
17	*C. Nardus*, Rendle var. *Confertiflorus*, Stapf.	Glaucous-leaved Mana	0·913	+12°12'	46·5	29·3	17·2
18	,,	,,	C·900	+4°	61·2	43·7	17·5
19	,,	White-stemmed Mana	0·908	+1°27'	54·8	30·2	24·6
20	,,	,,	0·904	+2°26'	58·0	24·8	33·2
21	,,	Red-stemmed Mana	0·929	+6°19'	39·1	19·4	19·7
22	,,	,,	0·909	+0°58'	57·0	28·9	28·1
23	*C. Nardus*, Rendle closely allied to var. *Confertiflorus*.	Lenabatu-Pengiri (not genuine)	0·905	+2°46'	52·0	31·1	20·9
24	,,	,,	0·902	—2°11'	63·1	39·5	23·6
25	,,	,,	0·907	—0°6'	64·2	44·8	19·4

In connection with the above, reference should be made to an abstract of a paper by de Jong on citronella grass, which is published in the Chemist and druggist. We have already referred to these investigations by de Jong and may now content ourselves with adding a few details to the particulars then communicated. De Jong proposes to call the *Maha-Pengiri* species, which is chiefly grown in Java, by the name of *Andropogon Nardus*, Java, and to designate the *Lenabatu* species, which is typical of Ceylon, A. *Nardus*, Ceylon; the former would thus correspond with *Cymbopogon Winterianus*, Jowitt; the latter with C. *Nardus*, Rendle, *lenabatu*. it is true that *Maha-Pengiri* grass yields more and better oil than does *Lenabatu* grass, but it requires a richer soil and more careful

* Comp. Report October 1909, 41. Stapf also considers it correct to designate the *Maha-Pengiri* species (Winter's grass) with the special name of *Cymbopogon Winterianus*.

cultivation than the last-named. As a rule, the grass is propagated in Java by dividing the old roots, the root-sections being planted so far apart that every new plant has a space of three square feet. No definite rule can be given for the number of grass crops to be cut in the course of the year, as it varies according to soil and climate. De Jong considers it best to cut the grass when the fifth leaf has developed. The distillation is often carried out in Java by superheated stem under a pressure of 3 to 4 atmospheres; this mode of working being more rapid and giving a higher yield, usually varying from 0·5 to 0·9 per cent. It is said to be of advantage to cut up the raw material as small as possible.

As in the case of *Maha-Pengiri* grass, de Jong has now also experimented on the oil-content of the leaves of *Lenabatu* grass in different stages of growth, and has obtained precisely similar results as with the *Maha-Pengiri* grass. The oil-yield diminishes as the leaf ages and so does the total-geraniol content of the oil. In the oils examined by de Jong this total-geraniol content reached a percentage (from 86 per cent. for the first to 75 per cent. for the sixth leaf) which had not previously been observed in *Lenabatu* oil.

DRUGS AND MEDICINAL PLANTS.

CEYLON COCA.

(From the *Chemist and Druggist*, Vol. LXXVIII., No. 1, 635, May 27, 1911.)

According to "De Indische Mercuur" of May 9, coca-planting has increased not only in Java, but also in Ceylon during recent years. Our contemporary states that the export of coca-leaves from Ceylon has risen from 419 cwt. in 1907 to 1,094 cwt. in 1910. The variety grown is stated to be mainly *Erythroxylon Coca* var. *novo-granatense*, and the yield of dry leaf is given as 100 lb. to 230 lb. per acre. The official figures of coca export from Ceylon up to 1909 were quoted recently in the *Chemist and Druggist* (March 4, p. 49), and those for 1909 are repeated here with the figures for 1910, as given by "De Indische Mercuur":—

Destination.	1909. Quantity.	1909. Value.	1910. Quantity.	1910. Value.
	Cwt.*	Rs.	Cwt.*	Rs.
United Kingdom	269	12,304	270	10,290
Belgium	201	6,326	374	6,931
France	—	—	5	161
Germany	14	3,621	13	470
Italy	—	20	375	16,961
Switzerland	123	6,822	53	3,000
United States	—	—	—	18

EDIBLE PRODUCTS.

COCONUT CULTIVATION.

By Mr. A. W. BEVEN.

[Read at the Annual General Meeting of the Ceylon Agricultural Society, June 20, 1911.]

It is not my intention in this paper to write a treatise on cocenut planting, giving estimates of the cost of opening an estate, &c., as such information is to be found in Ferguson's "Coconut Planters' Manual." My object is to write on the *cultivation* of a coconut estate.

Cultivation should commence immediately after planting. General rules will not apply, for some estates have hard gravelly soils, some heavy clayey alluviums, some loamy clay, some clayey loams, and others sandy soils varying in colour from a red sand to the white cinnamon garden sand called by the Sinhalese "maradan-vella,"

Planting.—The usual method of planting is to cut holes of 3 feet cube, or of other dimensions, according to individual idiosyncracies. At the bottom of these holes a little surface soil is thrown in, and on this the plants are placed. There are objections to this general system. In wet weather the holes get filled up with water, and if the wet weather be continuous, the plants get drowned. A second and greater objection is that the soil round the plants cannot be tilled by being loosened with mamoties, so as to give the plants a good start, as the roots are below the reach of cultivation till trunks are formed.

* Fractions of 1 cwt. omitted.

The system I adopted, when I took to coconut cultivation thirty years ago, was to cut holes 3 feet cube and to fill them with the surface soil cut from their sides to within one foot of the surface. By this means the holes become saucer-shaped, and are about 5 feet in diameter. Cultivation can, by this system, commence almost immediately after planting, and can be continued in an increasing circle with the growth of the plants and the spread of the roots. I was very gratified to find there was one other who followed this system, viz., Mudaliyar A. E, Rajapakse, on his Eheta estate, through which the Negombo line runs. Some people express the fear that by putting down the plants so near the surface the stability of the tree will be affected. There is no fear of that, for the bole of the tree, which is its sheet anchor, and takes the place of the tap root of other trees, will establish itself in the original hole, and even deeper, according to the texture of the soil.

Weeding.—The next operation calling for attention is weeding. This should be undertaken soon after planting. If the estate be weeded from the start, weeding will not cost much, and a beautiful sward will cover the ground. Most estates are planted on the *goyia* system, that is, the land is given to villagers to fell, burn, clear, and plant, and they are allowed a share of the subsidiary crops grown on the land, besides being paid at so much per tree and plant (previously agreed upon) at the end of a specified number of years. This system has its advantages and disadvantages. The advantages are obvious. One disadvantage is that the villagers do not supply vacancies till the time arrives for giving over. Then the landowner has an estate with a large proportion of plants just put out. Some experienceed planters think that minor cultivation impoverishes the soil and should not be practised. This it undoubtedly does, but not to an extent to be detrimental to the coconut plantation, particularly when manuring is practised. As against the impoverishment of the soil, there is the benefit accruing to it from constant tillage. In dry districts cotton could be grown as a subsidiary crop.

Tillage or turning over the soil with mamoties should go hand in hand with weeding. Every time the land is weeded, or at least once a year, the soil should be tilled in an increasing circle round the plants and mulched with weeds, which should be placed at least a foot to 18 inches away from the plants to avoid trouble with black ants (*kadias*). All laggards and recent supplies should have a large coconut shell full of kainit. When in course of time the edges of the tilled circle touch each other, the intervening spaces should also be tilled. Probably by this time the estate will have come into bearing, as a result of continuous tillage. After this the land can be ploughed. Efficient ploughing is not practicable on any but sandy soil, unless tilling precedes it. The land should be harrowed the year after tilling. These operations should be carried on in alternate years, so as to have the soil always in a fine state of tilth. Unfortunately every one does not realize the benefits of having the soil in a friable state. If brought into this condition, most of the rain water is absorbed by the soil; and air is drawn in after it, The soil therefore becomes aerated to a greater depth than the furrows made by the plough. Roots traverse further and deeper and find their way to the regions of permanent moisture. The loose soil on the surface acts as a mulch and prevents the evaporation of moisture. The roots having gone deeper and evaporation having been arrested, it follows, of course, that coconut trees are better able to withstand droughts and to bear and mature better crops. The aeration of the soil renders soluble the insoluble plant food in the soil. If Government abandons its dog-in-the-manger policy of destroying all the salt produced in excess of its requirements, and issues denatured salt to agriculturists, and this be spread over the soil before it is harrowed, the soil will be kept moist. In illustration of how little planters of experience, who, however, have not made a study of agricultural chemistry, realize the benefits of a thorough aeration of the soil, I may mention that recently a gentleman wrote to me and complained of the drought and and its effects as seen in the dropping of immature nuts. I suggested the procedure I have just explained, also a thick cover of *Crotalaria*. He writes in reply: "Thanks for your suggestions about ploughing, which I wish I could carry out more fully, though nothing will prevent the nuts being burnt in such weather as we are having, and the droppings from the young trees in the harder soils." He should not be too sure of the impossibility of overcoming these untoward results of droughts. None of us are too old to learn. A few acres might be experimented on, and the results watched and reported.

Draining.—This should be taken in hand as early as possible. The object of

draining coconut estates on hard soils and land with an undulating lie is the opposite of what it is on up-country estates. On coconut estates the cutting of drains or trenches should be to catch all the rain water that falls on it, and to allow it to pass *through*, not *over*, the soil. On up-country estates contour drains are cut to carry away the rain water. This is necessary, as the rainfall up-country is heavy, and the lay of the land is generally steep. If the soil be too saturated with water, there will be the fear of whole hillsides sliding into the valleys, especially where the soil overlies slab rock. A few years ago Mr. Coryton Roberts suggested catch-water trenches for rubber estates, and very useful they will be.

The draining I am, however, referring to is different from the draining of low ground, which is generally done when lands are opened and planted to drain off superfluous moisture. I lay great stress on the absolute necessity for catch-water drains on undulating land and for hard soils. There are two systems in vogue. The most common one, and that usually practised by villagers, is to throw the soil cut from drains on their upper side. This system is more correctly terracing. The soil being thrown on the upper side of the drain effectually prevents rain water finding its way into them. Rain water and silt are arrested by the banks of earth, and find their way out at the lowest level. What I practice and preach is for drains to be cut as nearly as possible at right angles to the slope of the land irrespective of the lines of the coconut trees. The earth should be formed into a bund on the lower side, so as to increase the capacity of the drain to catch water. They should not be of one continuous length, as, unless they are traced and cut absolutely level, the arrested water will find an outlet at the lowest point, and the remedy will prove worse than the disorder it was meant to cure. The drains should be cut in sections about 25 feet, leaving intervals of about 18 inches between the sections. The bottom of the drain should be so made that the water from one section should not find its way into another. The ends of the drain should be slightly rounded to prevent the water flowing out.

These drains can be gradually filled up with husks, coconut branches, and weeds, and when quite covered over new ones should be cut. Another benefit of these drains is that they help towards the aeration of the soil. Drains are useful on flat land as well, whatever the texture of the soil. They can be used as receptacles for the husks and branches, which, in decaying, enrich the soil. In such places the drains should be wide and shallow, so that a large surface may be enriched with humus. Here, too, new drains should replace those that are filled up and covered over.

Liming.—This is a very necessary branch of agriculture, which is almost entirely neglected in Ceylon. I do not intend writing a dissertation on lime, though a paper could be written exclusively on this one subject. The action of lime on soil is partly physical and partly chemical. It gives cohesion to a light sandy soil, and renders a hard soil friable. It is specially useful on alluvial and clayey soil. By its chemical action it sets free plant food which exists in an insoluble condition. Perhaps its most important attribute is that it assists the work of nitrifying bacteria. It should be applied to the land after it has been tilled or ploughed, and to trees a few months before the application of manure, so that it may have time to revert to the carbonate form by the action of the atmosphere and rain. Unless this chemical change occurs, the nitrogen in a manure that may be applied will be dissipated as ammonia. The action of manure will be increased by a previous application of lime to the soil. Now, as to the quantity of lime that should be applied per acre. In European agriculture it used to be applied at the rate of six to eight tons per acre at intervals of five to six years, but I believe this harmful system has now been abandoned. I advised a gentleman who consulted me about the treatment of a heavy alluvial soil to apply about ten bushels of lime per acre biennially. He was more than pleased with the result of the first application in the improved texture of the soil. It became quite friable. Whether he is continuing the application I cannot say. I think ten to twelve bushels per acre, according to the texture of the soil, every alternate year, after ploughing and a few months before the application of manure, will give encouraging results.

Manuring is the returning to the soil of the elements of fertility removed from it by cropping. The soil has been aptly likened to a bank in which the amount of credit is measured by its fertility. Crops are drafts on the bank. Their removal, without returning the equivalent in the shape of manure, results in the diminution of the amount at credit, or, in other words, in the impoverishment of the soil. Accepting the definition of manuring at the beginning of this paragraph, I have in practice always endeavoured to return to

the soil the elements of fertility removed by crops. The soil is drawn upon, not only to mature crops, but also for the growth of the tree and for the production of fronds. Unless the soil is exceptionally poor, the elements of fertility in the soil will be found sufficient for the growth of the tree and for the production of fronds. In practice I have found that a manure based on an analysis of the soil did not yield anything like the same results as a manure based entirely on the elements of fertility removed by crops. The earliest analyses of the coconut tree and its products were made by a Frenchman, Lepine. They were most elaborate, but have not been accepted as accurate. I see that they are omitted from the latest edition of "All about Coconut Planting." To my knowledge the next analysis was by Cochrane, at the time the City Analyst of the Colombo Municipality. He interested himself much in agricultural subjects and published a very useful book, "Ceylon Manual of Chemical Analyses." His analysis of 3,000 coconuts, representing the crop of one acre, was as under:—

		lb.
Nitrogen	... ...	50·25
Phosphoric acid ..	...	21·64
Potash	... ...	101·25
Salt	... ...	63·75

The next, I believe, was by Bachofen, at the time in the employ of Mr. Baur:—

		lb.
Nitrogen	... ...	25·97
Phosphoric acid...	...	7·35
Potash	... ...	56·25
Salt	... ...	64·26

The next I have is from the Philippine Agricultural Journal:—

		lb.
Nitrogen	... ...	56·04
Potash	... ...	57·09
Phosphoric acid...	...	15·78

It will be noted that, except as regards salt, Bachofen's analysis gives about a half of the other constituents as compared with Cochrane's and one-third of phosphoric acid. In the *Philippine Agricultural Journal* analysis the amount of nitrogen is slightly in excess of that of Cochrane's. The potash is practically the same as in Bachofen's. The phosphoric acid is a mean between Cochrane's and Bachofen's. The manure I have used, and with encouraging results, is based on Cochrane's analysis. I attribute the good results to the quantity of potash in the mixture, which is deficient in the soil to which I have applied it.

Cattle manure is a very valuable manure for coconut cultivation, whether on hard or on sandy soils. In its decay it adds humus to the soil, and the quantity of humus—a soil is the measure of its fertility. Hard soils are rendered friable with the addition of cattle manure, and it gives body and retentiveness of moisture to a light sandy soil. Where there is sufficient pasturage to maintain a herd of cattle, their droppings when tied to coconut trees yield very encouraging results, as the valuable liquid droppings are absorbed by the soil if it be porous. Evaporation can be arrested by the use of fibre dust or any vegetable matter spread round the trees to which cattle are being tethered. Wherever cattle manure or cattle droppings are applied, half the quantity of artificial manure usually applied should be used. Where cattle manure is not available, *Crotalaria* will be found to be a very useful substitute for the formation of humus. In common with other leguminous plants, it has the further valuable property of being able to appropriate nitrogen from the atmosphere to enrich the soil. All green matter, whether leguminous or not, should be buried so as to enrich the soil.

Analysis of the soil will be useful to find out whether the soil is acid. This can to a very large extent be corrected if the treatment before suggested of tilling and liming the soil be carried out, and also to find out whether the soil is deficient in any constituents. For, according to the "Law of the Minimum," if the soil be very rich in all the necessary constituents of fertility and be deficient in one, even the most unimportant, the crop will be adversely affected.

If the fronds be cut up and heaped and burnt, and the husks be removed to the different fields and be burnt or buried, the elements of fertility removed from the soil will be represented only by the nuts. The transport of husks to be burnt will be an expensive item of expenditure. If means could be devised to burn them where the nuts are heaped, without damaging the surrounding trees, the cost of transport will be diminished. If husks be buried, the resulting benefit to the trees will commence with their decay. On a heavy soil, retentive of moisture, the decay will be comparatively rapid, while in a sandy soil the decay will be very slow. If the husks are buried in small pits all over the estate, they will, in decaying, yield humus, which is essential to a fertile condition. Another source of humus is weeds, which it will be wise to always

fill into small pits. Humus and its formation have received much attention in recent years, since the growth of nitrogen-gathering legumes was suggested, and *Crotalaria* is perhaps the most popular of all leguminous plants. One drawback with the cultivation of large leguminous plants is that the whole surface of the soil does not get the benefit of the humus, only the pits where they are buried. Cannot the Agricultural Society introduce some species of small plants, like vetches or lupines, which can be readily turned into the soil in the process of ploughing or tilling?

These notes were strung together hastily during intervals of leisure, and have occupied many days. I trust they will prove of use to my brother planters.

A. W. Beven.

June 20, 1911.

THE BANANA, AND ITS CULTURE IN JAMAICA.

By the Editor.

(From the *Bulletin of the Department of Agriculture, Jamaica,* Vol. I., No. 4.)

Preface.—In the Bulletin of the Botanical Department for September, 1902, appeared a reprint of the paper presented to the Agricultural Conference at Barbados in 1902 by Mr. W. Fawcett, B.Sc., F.L.S., then Director of Public Gardens and Plantations, entitled "The Banana Industry in Jamaica."

So great have been the demands for this publication that the entire edition has been exhausted, and it appears imperative for the present Editor to prepare a new edition of a Bulletin dealing with the chief commercial staple of the Island in which the chief points of the cultivation of the banana, as carried on by our leading planters, may be briefly described.

Like all progressive industries, that of banana cultivation is subject to change and methods of planting, draining, pruning and general cultivation are modified from time to time and from place to place as our progressive planters find better and more efficient methods of achieving commercial success in the culture of this crop under the strikingly varied conditions of soil and climate in which bananas are now grown in Jamaica.

Since 1902, marked progress has been achieved in the culture of bananas in Jamaica on stiff clay soils by bold drainage and thorough surface tillage, and again in dry districts by the adoption of the mulching system for the preservation of moisture. An increase of at least one-third in the productive output of bananas in Jamaica has arisen since 1902, and it would appear that, with the improvement in means of transport and the opening up of interior lands the export of bananas from Jamaica will before very long reach the large amount of twenty million stems per annum.

The Banana Plant.

Musas.—The banana is the most important member of the *Musa* family belonging to the Natural Order *Scitamineæ,* which includes such economic plants as arrowroot, cardamoms, ginger, and cannas, while the native 'wild plantain' of Jamaica (Heliconia) and the graceful 'Traveller's Palm, of Madagascar are other members of the order.

Musas are the largest of the tree-like herbs, often attaining an extreme height of 25 to 40 feet, and have been compared, not inappropriately, to "gigantic leeks."

There are said to be about forty different species of Musa known in various parts of the world. Some of these produce leathery and inedible fruits, others ornamental spikes of flowers, while the bananas of commerce are practically restricted to the two species *Musa Sapientum* (of which the Jamaica banana is a variety), and *Musa Cavendishii,* the dwarf or Chinese banana as grown in the Canaries and Barbados.

Structure.—The banana plant may conveniently be considered under the four heads of (i) The Roots, (ii) The Stem, (iii) The Leaves, (iv) The Fruiting System.

The Root System.—(Fig 61.) The banana is a plant with a relatively large and extensive root system, and many of the problems of its cultivation are bound up with the conditions which affect the free and healthy development of the roots in the soil. When conditions are favourable, the roots of a banana plant will penetrate far and deep. If a healthy plant growing on a free, well-drained soil in a good tilth be carefully dug up, it will be noticed that there are two kinds of roots.

The surface roots are tough, cordlike structures that run parallel to the surface of the soil in all directions at a depth of about a foot. (Fig. 62.) These roots are of uniform thickness and do not branch like the roots of an ordinary tree, but persist as long, continuous cords. Delicate thread-like feeding rootlets project from the sides of these main root-cords, and thus enable

the root system to get into working contact with the soil for the nourishment of the plant. Just above the extreme end of the root-cords it will be noticed that the tissue is very soft and is firmly adherent to the soil. The extreme tip of the root is protected by a small covering of dead cells. The tender growing-point of the root is armed with a number of fine root-hairs that are very delicate and represent the chief centre of activity in the work of the root in the soil.

The second type of roots are the anchor roots that strike deep down and serve to fasten the plant securely in the soil, and to enable it to offer resistance to the wind and support for the bunch when it is formed. These anchor roots are similar in structure to the cord-like surface roots just described, but are softer in texture. In medium soils, these roots descend to at least four feet in depth, and should they meet with stagnant conditions in the subsoil the plant will turn yellow and the usual indications of defective drainage will be made evident.

Fawcett records that he traced the roots of a banana plant a distance of 17 feet from the stem, and that under favourable conditions the rate of root development was found to be 2 feet in a month.

On the other hand the root of a banana has a relatively weak penetrative power in the soil. It is unable to force its way between stones in the manner familiar to all in the case of hard-wooded trees.

Again, the roots of the banana are easily destroyed by any unhealthy conditions, and rot away when brought into contact with sour or water-logged soil.

When the roots are cut or broken, as by deep tillage, the broken ends will heal and an increase of thread-like absorptive roots will eventually develop above the point of healing.

If a banana sucker be inverted and closely cut with a knife,it will be noticed that the main cord-like roots have direct tubular connection with the base of the plant.

This explains why a poisoning of the root by unhealthy soil conditions many feet away from the main plant is immediately seen in the plant itself.

To sum up, the banana has an extensive root system, but one that has very weak penetrative power, and is exceedingly susceptible to any adverse conditions in the soil. Free drainage to a depth of 4 to 5 feet for the accommodation of the anchor roots and a mellow tilth for the free development of the roots in the surface soil, are two conditions that are essential.

In order to maintain the plant in a vigorous growing state, the surface soil must be maintained with a minimum amount of moisture for the nutrition of the root-hairs.

If the soil be allowed to 'dry out,' the root-hairs die and the main roots will themselves perish.

In districts where the rainfall is irregular, irrigation is required for the cultivation of bananas. A partial drought, however, may be most effectively met by the free use of mulching material (Guinea grass, pimento branches, or any vegetable refuse.)

The Stem.—Starting as a small structure in the centre of the 'bulb,' the stem of the banana is closely wrapped round with the bases of the leaf stalks. As the leaves grow, the food material they produce is stored up in large quantities in this basal reservoir, until when the leaf growth is almost complete the growing point of the stem forces its way up through the central channel formed by the leaf-stalks, and at length, when the bunch has been forced out at the summit of the plant, the stem becomes apparent as a supporter of the fruiting system of the banana plant.

If a plant in the fruiting stage be cut down and the trunk carefully dissected with a knife, the folds of the leaf-stalks can be removed layer by layer until at length the true stem be found in the centre as a cylindrical attachment to the fruiting system. If the stem be cut across it will be found to be of a fibrous consistency and filled with a sticky juice. The fibres can be traced down to the sucker below and indicate the direct connection between the fruit and the underground system of the plant.

The 'fingers' of the fruit, their association into 'hands' and the succession of 'hands' forming the bunch are the product of the stored material in the underground 'bulb' of the banana.

The material in the 'bulb' of the banana is partly ready made from the growth of a previous sucker, and partly the direct result of the manufacturing activity of the leaves during the life of the present plant.

If this store be inadequate, it is obvious that the fruit will also suffer. Healthy roots well-fed in favourable soil mean vigorous leaves with liberal manufacturing power.

The resulting store in the 'bulb' will in the end appear as a large bunch of fine fruit.

Should, however, the process of manufacture and storage be checked by poor tilth, inadequate drainage, sourness of soil, lack of moisture, injudicious maiming of roots by deep cultivation or by injury to the plant by storm, the resultant bunch will be in accordance therewith. When a bunch is cut, the stem and leaves decay while the food material therein passes down into the bulb.

Experience in Jamaica indicates that it is preferable to cut down the old stem and chop it up to form humus on the surface of the soil rather than to leave a tall stem slowly to decay, with a view to the maximum reinforcement of the bulb thereby.

The original bulb forms a reservoir of material for many successive suckers, and it is important that suckers should be rigidly pruned to a limited number capable of assuring good results, so as to avoid an unnecessary depletion of the store in the mother bulb by the production of superfluous and unproductive growths.

The Leaves.—The long elliptical leaves with the prominent mid-rib are so familiar to all in the tropics that it is hardly necessary to attempt a detailed description of the foliage of the banana.

The sheathing bases of the leaves act the part of a woody stem in supporting the huge leaf blades and carrying them up the sunlight. The leaves are fragile and easily torn and tattered by a storm of wind. It is surprising, however, how they will appear to perform their function as leaves, although the blades may be split into many fluttering sections as the result of a high wind.

After the birth of the bunch a small leaf is developed, which is specially provided for hanging over and shading the fruit from the strong light.

The fluted leaf-stalk of the banana acts as a conduit for the transference of water into the interior of the stem. This water has an important function in facilitating the delivery of the bunch at the apex of the plant.

During a period of drought the artificial spraying of water into the heart of the leafy stems has been found effective in enabling a stem to shoot its bunch.

The Fruiting System.—If a banana plant a few weeks before the time for shooting its bunch be cut down and dissected, the flowering stalk will be found in its embryonic condition in the stem. On examination of this structure it will be found that the flowers are arranged in clusters dispersed spirally round the axis.

It will be noticed that there are three sets of flowers clearly distinguishable by the length of the ovary; those with the long ovary at the base of the stalk become the 'hands' of the fruiting bunch and are female flowers.

At the other end of the stalk are flowers with very short ovaries, which are the male flowers, while intervening between the two are flowers with an intermediate length of ovary or abortive fruiting organs. (Fig 63).

The number of hands in the bunch is determined as soon as the three types of flowers on the stalk have been formed, and it is therefore evident that the grade of fruit is settled at a comparatively early period in the life of a sucker. The size of the individual fingers may be modified by subsequent circumstances, but the number of hands that a bunch shall contain is incapable of increase in the later stages of growth.

An examination of such a stalk would indicate that the number of hands in a bunch might be doubled if enough stimulus had been given to the plant to develop the abortive flowers into clusters of fruiting 'hands.' Commercially in Jamaica, a standard of nine hands regulates the maximum number which it is profitable to obtain, and skilful cultivation is directed towards the maintenance of this standard.

Experiments have been carried out to test the rate of passage of the bunch from the base of the plant to its delivery at the apex.

By passing coloured threads through the stems of plants in different stages it has been shown that it takes the bunch from three to six weeks to make this passage.

VARIETIES OF THE BANANA.

The Jamaica Banana.—This is the standard commercial banana and is known also by the names 'Gros Michel, and 'Martinique.' It was introduced into Jamaica about 1836 by *John Francois Pouyat*, a French Botanist and Chemist who settled in Jamaica in 1820. He possessed coffee property "Belle Air" in St. Andrew, and on his return from a visit to Martinique planted this banana on his estate. At first known as the 'Banana-Pouyat' it gradually became known as the Martinique Banana,

and now when any planter in Jamaica speaks of 'banana,' he means this variety and this alone.

The Agricultural Society of the time, on receipt of the first bunch of this banana grown by Mr. Pouyat, awarded him a doubloon for introducing so valuable a variety into the Island.

From this one plant have grown the millions of bananas that are now cultivated in Jamaica, while the commercial plantations of Central America and of Cuba are, we believe, of the same origin.

For size, flavour, symmetry of bunch and good shipping qualities no other banana yet tested in Jamaica can compare with the Martinique. In fact, it may be stated that no other variety of banana capable of commercial exploitation in competition with the present commercial fruit of Jamaica is known to exist.

Other varieties of Banana.—Some thirty varieties of bananas have been under trial at Hope for the past 7 or 8 years. Many of these are of high repute in India, Java and the East.

Several are undoubtedly the same banana under different names. The 'Apple' banana, with a pleasant sub-acid flavour, is an excellent fruit for the private grower, but is quite unsuited for shipment.

Before the fruits are ripe they become so fragile at the stalk that at the slightest touch the fingers become detached.

The 'Lady's Finger' and some of the Eastern varieties that closely resemble it are dainty dessert fruits, but not capable of commercial exploitation.

Some varieties such as the 'Ram Kela,' a red banana highly thought of in India, when grown in Jamaica have been found quite unsuitable for the local palate and of a very indigestible constituency.

A small fancy trade might be done in some of the red bananas and the small dessert fruits, but it is doubtful whether there is a single variety in the whole collection under trial by this Department, that it would be wise for any planter to cultivate to any extent.

The variety '*Cavendishii*' or the Chinese Banana is grown to a certain extent in the hills for local consumption. When grown in the plains in Jamaica it is too sweet and lacks flavour. This variety is best suited to sub-tropical conditions. It cannot be shipped 'naked,' and is quite inferior for all commercial purposes in Jamaica as compared with the Martinique.

BANANA SOILS.

In the early stages of the industry in Jamaica 'banana land' was accepted to mean a soil in which without drainage, without tillage, and by a superficial process of clearing and, perhaps, burning before the suckers were planted, a good yield of commercial fruit was obtainable by the grace of Nature alone.

Where fine alluvial deposit has been reinforced with the humus from a prolonged growth of forest or ruinate, and the district is a seasonable one, such old fashioned 'banana land' is still to be found in Jamaica, but in rapidly decreasing extent. To a superficial observer of the initial conditions of the banana industry in Jamaica it might have seemed as though the banana was pre-eminently a product of virgin soils, and that as the first flush of the stored fertility of these soils became exhausted, the growing of bananas would be difficult if not impossible. Under these conditions the vast area of virgin soil on the Spanish Main would appear certain to displace the resources of so small and long settled an island as Jamaica for the profitable cultivation of the banana.

Jamaica, however, in starting the banana industry, had behind its resources the traditions and enterprise of many generations of English and Scottish agriculturists of the first rank who had created the lucrative sugar industry in the old days, and had battled with adversity when that industry was so seriously prejudiced by the operation of the Continential Bounties on beet sugar. To planters of this grade, the cultivation of banana soon became more than the voluntary bounty of Nature in smiling on the favourable conditions of soil and of climate.

To men who had grown cane on the dry plains of St. Catherine by the use of irrigation, it was but a natural sequence to attempt the cultivation of the banana under the same conditions.

Now every drop of water available from the resources of the Rio Cobre System is being utilised in this manner and bananas are being produced on 10,000 acres of land that was formerly of nominal value for grazing purposes. These soils would be classed as natural banana soils, and the only condition required to make them productive is irrigation. Had they been in Portland and St. Mary these soils would have

been found capable of growing magnificent crops of bananas with very little modification of the forces of Nature.

It was ascertained very early in the history of the industry in Jamaica that the banana could not stand stagnation of soil. It was assumed that this crop could not be grown on the rich clays the St. Mary hills, and that the banana land in that entire parish was restricted to the alluvial bottoms and glades of rich, friable soil.

During the past decade the pioneers in St. Mary have demonstrated that from the very summits of the hills to the deepest glades, from the undulating folds of the upland hills to the flat clays of the coastal region there is hardly an acre of land that cannot be made to produce good bananas.

A bird's-eye view of this parish may now be likened to a vast expanse of bananas, and as new roads are opened out into the outlying areas an ever increasing spread of this cultivation is steadily taking place.

The chief cultural problems in St. Mary have been drainage, both on the flat and on hilly lands, and a lack of humus on the old lands which in some cases had grown canes continually for over a century before they were planted up in bananas. These problems have been tackled by the planters in that parish with the most remarkable success, and the results of contour drains on steep hillsides and of deep mains in the flat clay lands have shown that the heavy soils, when properly treated, are the best and most productive banana soils in the parish, while the growing of green crops and implemental tillage have restored worn soils to a pitch of full productivity.

In the parish of Trelawny are found some of the richest soils in the Island, but owing to the droughts that periodically occur, the bananas were found to be apt to dry out. The Trelawny sugar planters have long led the way in the art of mulching, and by the application of the grass mulch on a liberal scale on these old sugar lands it has been demonstrated that profitable crops of bananas can be grown despite the most adverse conditions of rainfall.

Even on the 'red-dirt' derived from the limestone it has been shown that good crops of bananas can be grown in such a parish as St. Ann by the judicious use of the mulch.

It is gradually dawning on our agriculturists that there are few cultivable soils in Jamaica below 1,500 feet in elevation where bananas cannot be grown by suitable methods of cultivation, drainage, mulching or irrigation where that is available.

In 1901 the writer commenced a study of the banana soils of the Island, the results of which appeared in the Bulletin from time to time, but as the years roll by so the range becomes wider and wider, until to-day it is hardly possible to classify any particular grades or types of soil as 'banana land.' If the working basis of the latest and most progressive cultivators be regarded, it would appear that a 'banana soil' and a 'cultivated soil' will soon be synonymous in Jamaica.

It would appear highly probable that many soils that have been tested under inadequate conditions of drainage or of tillage may in the near future yield success to planters with more enterprise and knowledge than their predecessors who have tried and failed.

For present purposes, a few soils typical of different classes and types of land on which bananas are grown with success have been selected, and their composition and analysis here set forth.

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ANALYSES OF BANANA SOILS.

Physical Analyses.

No.	Description.	Parish.	Gravel.	Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Agricultural Clay.	Combined Water and Organic matter.	Retentive power for water.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	First-class high land ...	Portland ...	0·41	5·46	28·89	23·65	13·77	2·72	16·49	25·10	44
2	Alluvial—good average ...	,,	3·23	7·97	44·38	30·20	7·05	0·54	7·59	6·63	45
3	Do	St. Mary ...	1·33	1·29	30·71	13·25	33·99	11·06	45·05	8·37	53
4	Alluvial—stiff soil ...	,,	0·26	0·94	22·07	22·87	24·11	17·45	41·46	12·20	63
5	Calcareous soil ...	,,	0·31	0·89	22·74	67·39	2·53	Traces	2·53	6·14	58
6	Upland heavy soil ...	,,	0·26	0·94	22·07	22·87	24·11	17·45	41·56	12·30	63
7	Lowland—light alluvial ...	,,	0·22	1·38	23·83	63·79	0·48	Traces	0·48	10·33	61
8	Irrigable alluvial —good average..	St. Catherine	2·75	11·27	40·79	39·34	3·06	0·49	3·55	2·30	46
9	Red soil ...	St. Ann ...	2·74	4·05	30·62	55·59	0·81	0·83	1·64	5·36	56
10	Alluvial soil ...	St. Thomas...	1·39	4·74	26·91	51·46	7·24	1·81	9·05	6·45	55
11	Alluvial soil—irrigable ...	Vere ...	1·12	0·50	32·32	54·72	4·57	1·41	5·98	5·36	54
12	Old cane land ...	St. James ...	1·52	0·68	11·72	72·98	1·81	1·63	3·44	9·66	62

Chemical Analyses.

No.	Insoluble Matter.	Potash.	Lime.	Phosphoric Acid.	Carbonate of* Lime.	Combined Water & Organic Matter.	Humus.	Nitrogen.	Moisture.	Available Potash.	Available Phosphoric Acid.
										Per Cent.	Per Cent.
1	27·87	0·6796	1·379	2·760	0·600	25·10	9·86	0·704	24·86	0·057	0·0908
2	67·59	0·572	1·881	0·161	0·221	6·63	1·75	0·118	4·90	0·021	0·0422
3	68·07	0·9249	1·62	0·138	0·506	7·93	3·58	0·196	7·62	0·027	0·0096
4	54·22	0·2907	0·2437	0·0254	0·120	12·30	3·15	0·211	9·66	0·015	0·0329
5	43·14	0·607	18·402	0·120	31·629	17·65	2·36	0·198	6·54	0·006	0·0238
6	54·22	0·291	0·244	0·025	0·120	12·30	3·15	0·211	9·66	0·033	0·015
7	64·03	0·960	1·191	0·085	0·316	10·19	1·14	0·089	11·51	0·004	0·013
8	78·54	0·392	1·022	0·218	0·174	5·52	3·61	0·162	2·35	0·053	0·064
9	18·17	0·172	0·254	0·393	0·454	25·34	3·62	0·130	5·66	0·011	0·007
10	62·44	0·853	2·560	0·246	1·560	—	1·81	0.172	—	0·013	0·044
11	68·93	0·573	0·951	0·168	0·296	9·95	2·81	0·155	5·66	0·021	0·044
12	57·04	0·321	1·294	0·229	1·748	13·91	4·53	0·310	10·69	0·007	0·0285

OBSERVATIONS ON BANANA SOILS.

No. 1 represents a very rich deposit overlying the limestone on an estate in Portland where magnificent bananas were grown year after year. This might be taken as an ideal banana soil, rich in humus and available plant food and of a rather retentive but not impervious consistency.

No. 2 is an average alluvial soil in Portland that has been long under cultivation, and is on the limit of productivity as first-class banana land.

This is a light soil from which the humus is rapidly abstracted under cultivation with a high rainfall.

The present standard of humus is low and the nitrogen also below par. Chemical fertilisers when tried on this soil were inoperative. The provision of vegetable matter to restore the humus is clearly the problem to be faced in this case.

No. 3 is a representative of a non-calcareous alluvial soil in St. Mary where excellent bananas are, and have been, grown for many years by good tillage and green dressings.

No. 4 is a type of the heavy banana soils of this parish. Forking and deep drainage have worked wonders on this material.

No. 5 is a representative of the alluvial deposits rich in calcareous matter that are largely found in St. Mary.

This soil failed to respond to the most generous applications of chemical manures, but at once yielded a full grade of fruit when subjected to thorough implemental tillage and top dressings of cow-peas.

No. 6. This is a sample of the hillside clays in St. Mary that were formerly regarded as hopeless for the growing of bananas.

Forking and drainage enabled excellent results to be obtained, whereas fertilisers were inoperative in the absence of such special aids to cultivation.

No. 7. This is a light alluvial soil from St. Mary that had probably been worked for a century as cane land before being put into bananas. In its present state it is rather below par in fertility.

The humus, nitrogen and potash are all low. Trials with fertilisers proved disappointing. Measures for increasing the humus appear to be all that is necessary for enabling such land to yield full returns of bananas.

No. 8. This is an average sample of the irrigable alluvial soils in St. Catherine as served by the Rio Cobre Irrigation System.

The mechanical composition is an ideal one for bananas under irrigation, and the employment of implemental tillage

During ages of dry conditions these soils were reinforced by the growth of the guango and other leguminous trees.

They are of a full standard of fertility, and on some of these soils over 90 % of straight bunches are obtained over a large acreage.

The 'Galls' that occur here and there in some fields are generally small areas of coarser sands devoid of humus. Experiment has shown that fertilisers have no beneficial effect upon these abnormal spots.

The reserves of fertility in the St. Catherine soils are very great, and if due care be taken to avoid stagnation from the excessive application of water, these soils should hold their own for many years to come as first-class banana lands.

No. 9. This represents a typical red soil from the limestone as existing in the uplands of St. Ann.

Such a soil has been found to be generally lacking in humus and to be subject to drying out during a period of drought.

Fertilisers were found quite inoperative, but recent experience on a fairly large scale has indicated that if liberally mulched with grass and other vegetable refuse fine crops of bananas can be grown on such soils.

It would appear that the practice of mulching would enable a large extension of banana cultivation on the red soils to be successfully brought about. It is noticeable that although derived from the limestone, the red soil has a very moderate content of this material now remaining.

The process of weathering frequently removes almost the last traces of lime from these soils, and in some cases the addition of lime has a marked effect on its productive powers.

No. 10. This is a sample of the soil from that magnificent alluvial flat at the eastern end of St. Thomas that was formerly of enormous value for the growing of cane, and is now in bananas.

These soils are excellent banana lands, and magnificent crops are obtainable if the exposed situation of the lands does not result in the loss of the crop by breeze as has too frequently been the case during the past ten years. It would appear to the writer that the wisest policy would be to utilize the bananas for establishing cocoa and coconuts on these lands, and eventually to abandon the

banana in favour of these crops that are not so subject to damage from wind.

The fertility of these soils and their adaptability to cultivation are even greater than the bare figures of the analysis would indicate, while the rainfall is liberal and the climate hot and humid and favourable to the growing of large crops.

No. 11. This is a soil that has been found to grow bananas well in Vere. The recent developments in the modernisation of the sugar industry in that parish have, however, encouraged the planters to grow more canes, and this would appear to be a more suitable and satisfactory crop for this, the most fertile alluvial tract in the island.

No. 12. This is a good specimen of some of the abandoned cane lands of St. James, which are rich but rather retentive soils requiring only thorough tillage and ample drainage to yield fine crops of bananas.

There are great possibilities for the extension of the banana as a cultivated crop in this parish, but in many cases special methods and treatment of the soil are required to ensure success. The 'Sugar-cane climate' associated with a dry spring is a difficulty which may require in some districts special measures for securing a good tilth and mulching to secure a good return of early fruit when the prices rule high.

Cultivation.

In dealing with this matter, it is obvious that there must be great differences between banana planting on a hillside clay in St. Mary, on an alluvial sand in Portland, on the irrigable lands of St. Catherine and on the old sugar lands in districts of partial rainfall. In each case the procedure would differ in some respects.

Again, as in most practical arts, several practitioners may attain equally good results by very different methods.

The details given in the following pages are those that have been kindly supplied to the Department by our leading planters and authorities on the practical cultivation of the banana, while hints from the Agricultural Instructors of the Department have also been embodied, and where so many have co-operated it would be invidious to mention names, but it is desired herewith to acknowledge and to thank all those who have assisted in this matter.

A leading Attorney of banana estates writes :—

Northside Cultivation.

"As a general example of cultivation, I will take the case of an estate on the northside where the soil is a heavy loam, 9 to 15 inches deep, with the subsoil of stiff clay, and the rainfall 90 inches. The general operations would be as follows :—

For plants, start in January, plough 9 inches deep, throwing a furrow 14 inches wide. This plough will require a team of eight cattle to pull it. Two ploughs will do 3 acres a day. Harrow and allow it to lie fallow till first week in March, then plough and cross plough 6 inches deep, and harrow. Line 14 feet square. Dig holes 2 feet 6 inches every way, and fill in with surface soil.

Dig suckers, beginning first week in February, one month before they are wanted, and only digging each week what can be planted each week a month later. Plant the second week of March to the end of April. Keep stirred with the plough 3 to 4 inches deep in fine weather, say every eight weeks, but in wet weather simply bill with the cutlass. Select the strongest shoot for the plant, which will fruit in the following February or March.

Prune off all suckers until June, then leave one sucker just coming out of the ground, which will fruit in the following April. In October leave another on the opposite side of the stem, which will fruit in the following spring twelve months. In February leave another, which will fruit in 15 or 16 months.

On such an estate 66 to 70 per cent. of plants, and 88 to 90 per cent. of first ratoons should give 'straight' or commercial bunches of nine hands. Taking a seven-year period, the yield should be 330 payable bunches per acre per annum.

Southside Cultivation.

"On the southside after lining at 15 by 15 feet, the irrigation canals would be laid out and water supplied to young plants every 5 or 6 days, to ratoons every 10 days, at the rate of 2 to 2½ cubic yards per hour to each acre. No plough is used for the first three years on this light soil, but instead the hoe and the Assam fork.

I will now go more into detail.

Preparation of Land.

Clearing.—In ground covered with forest or woodland some are content to cut down and burn, leaving the stumps to decay ; but it is better if it can be done, so to fall the trees that they will tear up their roots in their descent. The tree should be carefully selected,

marked and cut up for their special uses,—timber, posts, piles, tramway sleepers, firewood, etc. The underwood and brush can be used to burn up the roots and the trunks of useless trees such as Guango, Bastard Cedar, etc,

The ground should finally be carefully stumped. Even if the land is virgin soil and does not require ploughing, it is better to stump at first. The plants can then be put in at regular distances at once—an important matter in many ways, and if ploughing is necessary at a later period, there is no delay caused in digging out stumps. Stumping also facilitates cutting and carrying the fruit.

If the land is not the virgin soil of a forest, and especially if it be old cane land or pasture, it should be first thoroughly ploughed at least 9 inches deep. If the situation is on hillsides where the plough cannot be worked, the pickaxe for stony ground and the fork for soft soil should be used."

Distance.

The usual spacing of the plants adopted in Jamaica is 14 feet by 14 feet. Some planters adopt a wider spacing of 15 feet each way. Others plant two suckers at each hole, 14 feet by 14 feet, so as to get a heavy return with the plant crop in the spring months when prices rule high. The experiments that have been made by many planters in close planting at such distances as 10 feet by 10 feet and 8 feet by 8 feet have shown that although apparently a larger number of bunches can be grown to the acre, it has been found on further trial that any departure from the usual system of 14 feet spacing which is now generally adopted in Jamaica is not advantageous in the long run.

There are many soils where the plant bananas return a grade of fruit at least 25 per cent. lower than the succeeding crop, and the result of the second crop would therefore outweigh any advantage first obtained by growing a larger number of stems per acre from the plants, when those stems are below the standard grade.

Preparing Holes.—Some planters are content with shallow holes about one foot deep. But better results are obtained when holes 2 feet 6 inches every way are dug; the roots get a better start, and a better hold on the ground, so that the plants are more forward and are not so liable to be blown down.

A planter who prepares holes 3 to 4 feet wide and from 2 to 2½ feet deep, writes:—"It is not always possible to get the labour to make these holes, but I am convinced of the advantage and ultimate economy of making them large and deep, for among other reasons, the plant gets a start at once, a good root is formed in loosened earth which practically 'anchors' the tree, and enables it to resist high winds, and when planted in this way, the tendency of the root to come to the surface is greatly obviated."

Planting of Suckers.

Time of Year.—If the aim is to get the main crop in for the American market from March to June, planting is generally done from January to April. Otherwise planting may go on at any time when rain or irrigation water can be relied on to help on the young plants. There is no doubt, however, that March and April is the best time for planting when all vegetation is springing naturally. In April there are always showers which help to start the eyes of the bulb in putting out leaves and roots, and when the May rains come, the young suckers rush along faster than at any other time of the year.

Seed-suckers, Size.—Suckers are selected for planting 6 to 8 months old; they would then be about 10 feet high, with large swollen bulbs 8 to 10 inches across. They should always be suckers which have not been pruned, and these are indicated by the first leaves being very narrow in proportion to their length, hence called 'sword' suckers.

Preparation.—They are cut down to within 6 inches of the bulb, and the old roots trimmed off. Some planters put them in the ground at once, others leave them to dry for three or four days, and then plant. Others again find that they get better results by piling them in heaps 8 to 10 deep, then trash is thrown over them to keep off the sun, and they are left a month. The best way to pile them is to erect fences 3 feet 6 inches high to enclose a convenient spot 6 feet wide and of any length necessary.

Position.—They are placed in the ground with the eyes 3 inches below the surface. On hill-sides they are put in slanting, and an eye at the sides developes into the plant. On the flat they are set upright; if the centre sucker happens to shoot it is left; if not the best of those growing all round is selected. Some planters, even on level ground, plant their suckers slanting, as few eyes develop into suckers, and the strength is thrown into the formation of the bunch which is consequently finer.

The soil shoud be well drawn up over the bulb when planted.

IRRIGATION AND DRAINAGE.

Trenches.—The water channels should be close to the suckers when first planted, but when the plants are well established the channels should be made in the centre of the rows, for if the water is applied close to the base of the stem, it encourages the production and growth of suckers, and in this way unnecessarily weakens the plant.

Drainage.—Perfect drainage is absolutely necessary for bananas. It is even more important to elaborate a system of drains for an irrigation district than to provide water canals, for more harm is done by having too much water than too little. But drains are equally important on clay soils or subsoils when the water is supplied by the natural rainfall. On ground where there is not much fall, the drains naturally follow the slope. But on hill-sides they should be made across the slope with only just sufficient fall to carry off the water; if there are natural gullies the drains are led into them. In making drains it is a great mistake to make them too shallow from motives of economy.

CULTIVATION AFTER PLANTING.

Various opinions are held by banana planters about ploughing. Some who have planted in light, loamy soils have been reaping excellent crops for some years without any ploughing. Others, with heavy soil, plough every eight weeks with a 6-inch plough, alternately one way and across. Others again plough only once a year. On heavy soils in wet districts the plough has been abandoned in favour of the fork to get advantage.

A planter who is establishing a cocoa walk with bananas—before planting—ploughs, cross-ploughs, harrows, and, when necessary, trenches, afterwards he ploughs with a small plough (with moon-coulter attached) three to six times a year. On banana lines, where a plough cannot work, he forks occasionally and hoes frequently. He says that the plough is far more effectual in breaking up the soil than any other implement he has tried, and it keeps the land clean much longer. The plough works from 4 to 6 inches deep, and the cultivator 2 to 3 inches. Another planter forks once a year, and uses the cultivator to keep the weeds down. When the grass is too high for the cultivator he uses hoes, and only substitutes the plough for the hoe or cultivator when labour is scarce. Both plough and cultivator are kept to two inches in depth in order to avoid destroying roots.

A planter of wide experience writes as follows:—"I do not think that ploughing close to the banana and cutting through the roots does any harm. On the contrary, I am certain it does good, principally I think because the cutting gives fresh impetus to the roots, and this activity increases the growth of the plant."

Where ploughing is not the practice, the fork is used to great advantage when the young suckers are two months old.

Where the rains are constant, and the soil heavy, the cutlass is the best tool in weeding. The hoe and the Assam fork and the cultivator are tools used under different conditions. The disc-harrow is an admirable instrument, and should be in constant use so long as the soil is sufficiently dry. If the ordinary plough forms a pan, a subsoil plough is used occasionally to secure good drainage.

TREATMENT OF SUCKERS.

Reason for Pruning.— Pruning away such suckers as are not intended to yield fruit is a most necessary and important operation. It should be done when the sucker is not more than one or two feet high. The larger the sucker grows, the more food material it abstracts from the parent bulb, and the more its young roots interfere with the root system of the plant, in both ways injuring the future bunch.

Method.—Care should be taken when cutting away the suckers to apply the cutlass, so that it does not point towards the plant, otherwise it is very easy to injure it. If the sucker is not cut away quite down to the white hard part, it will soon spring again, therefore time and labour are saved by doing it thoroughly at first.

Choosing and Timing.—Suckers shoot from the newly-planted bulb from eyes all round, and sometimes from the centre. Some planters cut away the central sucker; others leave it, as it gives a fair bunch if the bulb is vigorous. On the south side, in irrigated land, two or three suckers may be left at equal distances round the bulb. It is well to take those that start from eyes placed low down, so that the roots have a good hold on the ground. One sucker takes the lead, as a rule, and becomes the plant, fruiting in ten to fourteen months; another comes in as a second sucker, giving a finer bunch four or five months later. Occasionally all the suckers will bear at the same time when the bunches will not be so fine. It is the practice with some planters on the north side after planting in March and April for fruit in February or March to prune

off all suckers till June, then to leave one just coming out of the ground which will fruit in the following April; in October another is left on the opposite side of the stem, and in February another which will fruit in fifteen or sixteen months. On the south side two suckers would be left instead of one in June, October and February.

Plants vary according to soil, situation, tillage, etc., in the time they take to produce fruit, under favourable conditions the time may be ten months to shoot, and two and one-half to four months more to ripen; but the growing period is frequently longer than this. Ratoons usually bear in fifteen or sixteen months. Judging from experience of his own estate, the planter can by careful pruning so regulate his banana walk when once established that the great proportion of the crop shall come in during the months of high prices from March to June. Unless soil and climate, however, be of the best, it is not sound policy to attempt too much in this direction, or disappointment will ensue. Where there is a check to the banana crop in the winter months due to cold or lack of favourable rains it will be found better policy to cultivate and prune for rather a later crop than the earliest to suit the American market.

Pruning Leaves.

As the first leaves decay, they hang down all round, protecting the stem from the full glare of the sun. If they are cut away, the sheathing leaf-stalks on the outside of the stem dry up, and do not perform their proper function. It is well to leave them even in the shade of a banana walk unless it happens that the plants are clustered closely together, when too much shade causes the stem to lengthen out and become weak and brittle. In such a case some of the dead hanging leaves may be pruned away, and some even of the living green leaves. In pruning the green leaves a semi-circular instrument is used mounted on a long handle; the convex edge is uppermost, and with this the leaf-stalk is partly cut through, when it falls over and hangs like one which has died naturally. Sometimes a leaf is seen to be growing through a bunch, and as it would, if left, cause some deformation or discolouration of the fruit, it is carefully removed with the pruning tool from its position.

Harvesting.

When the bunch is to be cut, the stem is partly cut through some 9—10 feet from the ground, and the bunch with the whole top of the plant topples slowly over. Care is taken that it does not fall against and injure any other plant.

The usual custom is to cut fruit by the hundred stems, each cutter by himself, without help, cutting the fruit with a cutlass, and catching it. This is, perhaps, a doubtful practice, as owing to want of method, cutters running through the walks miss or roughly cut much of the fruit. A better plan is to employ a cutter and a helper who work together. The cutters with their helpers work in line, each cutter having three rows assigned him, or, in close planting, only two rows.

On some estates particular care is taken in harvesting; one man with his pruning tools cut and manipulates the fall of the head, while another catches the bunch, and when the stalk is cut hands it to one of the women who are employed to carry it to a particular spot. This is necessary when we remember that a bunch weighs from 50 to 60 lb. Here a book-keeper enters it in his book under its proper denomination as a 'bunch' or of '8,' '7' or '6 hands,' or he rejects it if necessary as not full enough or too full. The bunches are wrapped in trash and handed up by two men to another in a waggon, who packs them in carefully, so that there shall be no bruising.

When the bunch is cut off, the head is completely severed from the stem 2 or 3 feet above where it was partly cut in order that the bunch might fall. Thus an elbow remains on the stem, and the whole is left to decay, while the top part of the stem and the leaves as well are cut up into small pieces with a cutlass. When both are fresh cut, a man can easily chop one hundred stems a day. The chopped up stems are spread over the land which can then be ploughed without obstruction, while they help to manure it.

Replanting.

It is considered advisable to replant a banana walk after an interval which varies from three to six years. A certain proportion is taken each year, so that every year some planting is going on. It is the custom with some to sow velvet beans and bonavist beans (*Dolichos Lablab*, var. *albiflora*—Sem, Sim or Sembi of India) or the Jerusalem pea (*Phaseolus trinervius*) in the field that is to be thrown up. These leguminous climbers soon cover up the old suckers and kill them, and after some time the whole may be ploughed up and replanted. Some are trying planting between the rows of first ratoons, as it

is easier to regulate plants and first ratoons for the American market than later ratoons.

The question of replanting must be decided from various considerations; the field may be getting out of shape from the various ways in which the suckers have sprung from the parent plant, making it difficult to cultivate; the soil may require rest or a more thorough ploughing than can be given while stems are growing; and there is the commercial question of its paying better to plant for the American market. After the hurricane in August of 1903, it was demonstrated that replanting in the following spring was the soundest policy, although it sacrified immediate prospects of a return.

COST OF CULTIVATION AND RECEIPTS.

In considering the cost of preparing land and of cultivation afterwards, certain expenditure, for instance that on building, road, fences, tram-lines, may well be entered as charges to be spread over a certain number of years.

In the irrigated district of St. Catherine a fair average amount that should be allowed for preparation of land and cultivation until the bananas begin to bear, is £15 an acre, and the annual expenditure afterwards would be £10 an acre.

The yield ought to be at the rate of 225 to 230 bunches paid for per acre, and taking the contract price all the year round at £8 15s. per 100, the receipts would average £20 an acre.

Whether the same price is paid for bananas throughout the year, or whether it varies as it does for the American market, the total annual receipts for a number of years have averaged double the amount of the expenditure on certain favourable estates

In the banana districts of the northside, taking the average of the whole run of estates from Port Antonio westwards to Rio Bueno, the cost to bring an estate into bearing would be about £10, and the maintenance afterwards £7 10s. The yield may be put down at 175 to 180 payable bunches per acre.

We have been favoured by a banana planter with the following abstract of accounts for one year. It refers to an estate of 200 acres in an irrigated district no the southside :—

EXPENDITURE.

	£.	s.	d.	£.	s.	d.
Cultivation—						
Preparing lands ...	11	13	1½			
Lining ...	0	15	0			
Planting ...	1	12	6			
Trenching ...	5	4	1½			
Forking 240 acres	52	10	4½			
Stumping ...	0	4	6			
Weeding 775 acres	252	18	5			
Pruning ...	75	1	0			
Propping ...	1	11	3			
Suckers : carting, supplying, etc.	26	17	8			
Manure ...	1	11	10			
				429	19	10
Irrigation—						
Cleaning trenches	11	18	1½			
New trenches ...	3	16	3			
Irrigating ...	124	19	9			
Water Rates ...	176	2	2			
				316	16	3½
Removing Crop—						
Cutting and carrying ...	205	8	7½			
Carting ...	123	3	11½			
Carriage by railway ...	206	10	1			
Wharfage ...	178	3	10½	713	6	6½
Supervision ...				203	12	6
Rents, Taxes and Insurance				260	9	8
Miscellaneous—						
Fences, Carts, Posts, etc. ...	7	4	4½			
Roads ...	4	17	9			
Buildings ...	9	11	6			
Supplies ...	16	8	7			
Tax on Coolies ...	19	3	0			
Headmen, Watchmen Messengers	44	16	9			
Sundries ...	12	7	7			
				114	9	6½
				2,037	14	4½

BANANA ACCOUNT.

Bunches.	Eights.	Sevens.	Sixes.	Total cut.	Payables.
23,356	16,016	12,778	4,468	57,612	43,827

Average of payables out of total cut—76 per cent.

RECEIPTS.

	£.	s.	d.
Bananas ...	3,589	13	5
Suckers ...	35	15	5
Miscellaneous ...	10	1	10½
Total ...	£3,635	10	8½

ON ANOTHER ESTATE.

The following selected details from a non-irrigated district on the north-side

will be useful by way of comparison. The soil is loose and gravelly without clay, rain 150 inches; thirty one acres were planted to produce a crop the following year. There were besides 135 acres yielding fruit, of which fifty acres were plants, and eighty-five ratoons:—

	£.	s.	d.
Clearing and preparing land ...	10	15	10½
Stumping ...	13	9	10½
Ploughing ...	43	19	1½
Trenching ...	16	7	7½
Procuring plants and forking ...	33	18	4½
Planting ...	9	6	4½
Weeding 470 acres ...	148	3	4
Ploughing and harrowing 580 acres ...	121	13	4½
Pruning ...	28	6	4
Propping ...	5	16	10½
Reaping ...	78	17	10
Carting ...	12	5	3

The total expenditure was £1,250.

The payable bunches amounted to 40,916 or 303 to the acre.

The receipts were £458 from miscellaneous sources, coconuts, cattle, cocoa, and £2,210 15s. 3d. from bananas.

AREA UNDER BANANAS.

In the last returns of the Collector-General the following are shown as the areas under bananas in Jamaica last year in each parish:—

Acreage in Bananas in each Parish in 1900-10.

Parish.	*Acres.*
Kingston	—
St. Andrew ...	1,295
St. Thomas ...	5,864
Portland ...	8,891
St. Mary ...	28,610
St. Ann ...	2,200
Trelawny ...	1,460
St. James ...	2,285
Hanover ...	3,164
Westmoreland ...	423
St. Elizabeth ...	254
Manchester ...	311
Clarendon ...	1,591
St. Catherine ...	12,758
Arrears ...	871
Grand Total ...	69,066

EXPORT.

In 1901 Jamaica exported 8,248,485 stems of bananas, while the latest returns from the Collector-General show this trade during the last four years to be as follows:—

FRUIT, BANANAS.

Years.	Qualities. Stems.	Values. £.	s.	d.
1909 ...	16,712,210	1,403,829	15	9
1908 ...	13,942,567	1,038,721	5	1
1907 ...	16,009,662	880,531	8	2
1906 ...	14,981,145	842,689	8	2

The prices given by the Fruit Companies per 100 bunches to those who contracted to supply a certain number all the year round have in recent years been as follows, although local conditions affect the prices paid for bananas, and it is not possible to quote any general prices applicable to all circumstances:—

January, £6; February, £7 10s.; March, £10; April, £12 10s.; May, £12 10s.; June, £11 10s.; July, £7 10s.; August, £5 10s.; October, £6 5s.; November, £6 5s.; December, £5 10s.

PAPAW CULTURE IN THE PHILIPPINES.

(From the *Queensland Agricultural Journal*, Vol. XXVI., Part 5, May, 1911.)

Mr. Jesse, of Jolo, tells of his method of raising papayas as follows. The process of cultivation is divided into four stages:—

First. The sprouting stage. The seed should be planted in boxes, about 18 in. by 18 in. by 8 in., containing rich earth, with which is mixed a couple of handfuls of bone ash and 15 drops of tincture of iron. Plant the seed about 1 in. apart and bury about 1 in. below the surface. The surface should be sprinkled lightly with water about sundown. In about a week the young shoot should appear, and at three weeks the shoot should be about 8 in. high.

Second. The stage of preparation of the soil for the transplantation of the young shoot and its early development.—Having located the site for the tree, dig a hole about 2 ft. in diameter and 1 ft. deep. Procure enough rich earth mixed with bone ash to fill the hole, and then sprinkle 15 drops of tincture of iron over the surface. Now dig up your sprout, being careful to retain the earth about its roots, and bury about 2 in. deep. In order to protect the young shoot from the direct sunlight, drive four sticks into the ground around the sprout and suspend a gunny sack. After about two weeks, the young plant will have adjusted itself to its new home, and the sunshade may be removed. By this

time the plant should be in a flourishing condition, and in three weeks should be 3 in. in diameter at the base.

Third. The forced nourishment stage, —Bore a hole in the trunk about 6 in. from the ground, 1 in. deep and of a diameter slightly larger than that of the red rubber tubing obtainable at your drug store. Fill a quart bottle half full of sugar and dissolve in water. When the sugar is thoroughly dissolved, connect the bottle with the hole in the tree by means of red tubing. In twenty-four hours the tree will have absorbed the contents of the bottle.

Fourth. The fruit-bearing stage.—If the young fruit appears too numerous, it is well to pluck the least promising. Then, if the tree is unable to support itself, prop it up. At five months some of the fruit on the lower cluster will show streaks of yellow. Now is the time to hasten the ripening. This is done by wrapping a gunny sack about the lower clusters of fruit and the trunk. Crows are very fond of the ripe fruit, and this expedient serves also to scare them away. When yellow spots about the size of a peso appear, pluck the fruit and place it in a cool dark place for several days. By this time the fruit should be yellow over the greater part of its surface, and will gently yield to thumb pressure. It is now ready for the ice-box. If the fruit is allowed to turn yellow before it is plucked, much of its strength is drawn back into the tree, to be supplied to other fruit in a less advanced stage of development. If these directions are followed, your trees ought to bear fruit 10 in. to 12 in. long, and 6 in. to 8 in. in maximum diameter.

Once a year sprinkle bone ash over the surface around the base of the tree. This should be sufficient fertilisation.

The tree (Javan) at maturity varies from 15 ft. to 20 ft. in height and is about 7 in. in diameter at the base.

TOBACCO CULTIVATION IN CEYLON:

VIEWS OF AN EXPERT.

A GREAT FUTURE FOR THE INDUSTRY BUT A SYSTEMATIC BEGINNING NECESSARY.

(From the *Times of Ceylon*, May 11, 1911.)

We have had the views of several authorities from time to time on the tobacco industry of Ceylon—some favourable and others much less optimistic. The subject is one that has received considerable attention. Government went so far a few years back as to decide to get out an expert; but the scheme fell through. Instead a commercial trial to produce Sumatra wrapper tobacco was begun at Maha-illuppalama, with the assistance of Mr. E. Cowan, who was for a few years assistant of a Tobacco Company at Sumatra before he came to Ceylon, and whose services the Ceylon Agricultural Society gladly availed itself of.

At present there is in the island a tobacco expert, Mr. J. van Leenhoff, who has had considerable experience of tobacco investigation work in various parts of the world. Mr. van Leenhoff was Chief of the Tobacco Division of the Transvaal and late Government Tobacco Expert of Porto Rico and of the U.S.A. Department of Agriculture, Washington, D.C. He is a holder of the certificate of the "Ecole d'Application des Tabacs," Paris, and of the Imperial Tobacco Manufactures, Strasburg, Germany, and he has reported on the Tobacco Industries of Cuba, Rhodesia, Orange River Colony, and Mauritius.

Mr van Leenhoff came to Ceylon in January last, having been recommended by Professor Wyndham Dunstan to advise and report on the pioneer cultivation of tobacco carried on on Molesworth Brothers' Estate in Trincomalie. The Ceylon Agricultural Society took the opportunity of Mr van Leenhoff's presence in the colony to ask him to also report on the tobacco experiment at Mahailuppallama, while the Ceylon Government also appointed him to visit the various districts in the island and report on the whole industry. Having concluded all three commissions, Mr van Leenhoff is sailing today for Europe.

FUTURE OF TOBACCO IN CEYLON.

Seen by a representative of this paper yesterday, Mr. van Leenhoff very courteously expressed his views.

"From samples grown in different districts which I have seen, I think there is a great future for the tobacco industry in Ceylon," said Mr. van Leenhoff. "But you must start systematically from the beginning. You cannot create a sound tobacco industry without carrying it out on scientific lines. It is a very sensitive crop—sensitive to environment, soil, climate, &c., and last but not least, to treatment in the field, shed, warehouse, and factory; and it is only a scientifically-trained expert that can appreciate all these points. I have observed that there is a tendency among cultivators in Ceylon, who are keen to try to improve their crops for European

taste, to simply import seed which is grown in other countries regardless of the difference in conditions. If they go on like this it will probably take them a great number of years to find out the kind of tobacco likely to give the best results, if at all. In other words,

TRIALS SHOULD NOT BE MADE ON A COMMERCIAL SCALE,

as negative results will cause financial ruin. You can't make a profitable investment of a tobacco plantation, when it is yet unknown in which direction to proceed. For instance, Turkish tobacco seed planted in a heavy clay soil with an abundant rainfall will not produce Turkish tobacco as it is used by cigarette factories. The leaf will be too large, too coarse and too dark, and of no use whatever for cigarette purposes. The same remark might apply to Sumatra seed, which is not liable to produce a wrapper leaf under conditions totally different to the original country of production. You might out of 1,000 seedlings be lucky to get one or two plants which show adaptability to their new surroundings. The thing has to be carefully watched. That is why I say you must start from the beginning. That means making several trials in small plots in the most promising districts, carefully studying their growth, and final product, and thus ascertaining the leaf that is likely to have the best commercial value, which could be done in co-operation with private planters, who are very keen on it, and who appear ready to offer land and buildings. If you get only one kind of tobacco in one particular district then you know exactly where you are."

A VISIT TO JAFFNA.

"You have been to Jaffna, of course?"

"Yes, and it seems to me that it is the only place in the island where tobacco is taken up as an industry. The cultivators of the North aim chiefly in producing a chewing tobacco, and as long as they have got a good market for that product I would not advise an alteration in the treatment. An attempt to alter their tobacco might lose for the cultivators the market they have already, and the ruination of the industry would be involved. But as there is a tendency to over-production of tobacco in Jaffna with regard to the market demands, it is absolutely necessary to take immediate steps to produce a kind of tobacco there which is suitable for the European market. The cultivators being very industrious and used to tobacco work, it is my firm opinion that very good results might be expected of systematic experiments there on the spot. The tobacco used for making cigars, of which the methods for developing the best qualities of the leaf are rather primitive, could very well be used for cigar filler purposes, even for European cigars, if properly developed, sorted, &c.

A MATTER FOR GOVERNMENT TO TAKE UP.

While naturally not wishing to say anything about the experiments at Maha-iluppalama, as his report has just gone to the Agricultural Society, Mr van Leenhoff is of opinion that proper investigation is a matter that Government should seriously take up. "An expert should be engaged to carry out investigations so as to get sound information at a minimum of time and cost. Only by these means can you arrive at a conclusion as to the best tobacco which can be produced in Ceylon. An expert is necessary, as the question of fertilization, treatment of seed and curing require the most careful attention; while the main point in all districts is to choose the right time for planting as regards rainfall, so as to avoid irrigation expenses and coarseness of leaf as much as possible."

"You are of opinion then that European markets can be found for tobacco grown in Ceylon?"

"Yes, decidedly so. The Jaffna tobacco as it is, if kept in bales for a certain period, may be used for blending, as it has the original aroma. I have no doubt that you can create a large industry for planters in Ceylon. The field work lasts only three months. The curing (or drying) takes three to six weeks, and the small planter need not bother about the process of fermenting, as this could be done by the dealers in tobacco or the manufacturers themselves. In any case, the tobacco could simply be baled and kept in a warehouse for a year or so to undergo the ageing process or a slow fermentation."

THE TOBACCO DISTRICTS.

"What are the districts which have struck you as being most suitable for the cultivation of tobacco?"

"Dumbara, I consider to be quite suitable for the cultivation of aromatic tobacco, more particularly cigar tobacco, which would, of course, obtain better prices. Certain parts of Trincomalie are also suitable for the growing of smoking tobacco. But they should not be too near the sea, and the precaution must be taken to experiment with a plot to test the burning qualities. I am of opinion that there are places in Jaffna where

smoking tobacco can be grown to advantage; but, as I said, to make the industry pay by finding outside markets you must start from the beginning and find out which tobacco can be most profitably grown according to the conditions of soil and climate where the cultivation is carried out."

Mr. van Leenhoff is taking away with him several samples of Ceylon tobacco leaf, his collection including some very fine specimens of tobacco grown as a catch crop on Messrs. Molesworth Brothers' estates in Trincomalie. His reports on the experiments at Maha-iluppalama and to the Government will be looked forward to with interest, and should lead to a better understanding of the whole question of tobacco cultivation in Ceylon. It would have been an additional advantage of much value if Mr. van Leenhoff could have carried out practical investigations and demonstrations as he has done in other countries, where he has served the Governments in a practical way and left behind him valuable reports and data, if not actual guides.

MAPLE SUGAR.

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLVI., No. 12, March 25, 1911.)

Ranking prominently among the manufacturing and commercial industries of New England, yet sometimes classified as a farm industry, is the maple sugar business of Vermont.

Historically it dates from the time of the Indians, who were accustomed to make sugar from the sap of the maple, by whom the art was introduced to the white settlers, not of Vermont, however, but of New Hampshire, for Vermont in the early colonial times was a part of New Hampshire. The Indians valued highly the sugar of the maple, and they used it as an agreeable flavouring for the dishes made from maize or the Indian corn. The advent of the sugar making season, when the sap of the maple tree began to run, was celebrated by the Indians with a special ceremony, and a dance was given in its honour. The opening of this season in the spring was regarded with the same reverence and deference by the New England Indians as the harvest moon and the season of the wild rice by the Indians along the western lakes.

The Indians tapped the maple trees by udely gashing them with their tomaawks and collecting the sap in dishes of birch bark. The sap was reduced by the continuous introduction into it of hot stones until it became syrup and subsequently sugar. The product of the Indians was very dark, almost black, and of the texture of gum opium, and it was rather bitter, as well as sweet, the result of the smoke, foreign matter and scorching.

The Indians, however, secured another form of sweet from the maple tree which was quite different from the syrup and sugar and much more attractive. It was in the form of wax, a maple wax looking very much like honey. This maple wax was evaporated in the sun, and it was obtained in another way also. Late in the season, near the conclusion of the sap flow, the small quantity that still exudes from the tree is very heavy in sugar and very sweet. This late sap, as it slowly trickles down over the bark of the tree, is quickly transformed by the warm spring sunshine into wax, and even to civilized people this maple wax is a delicious confection. It is probably unknown in New England to-day, but if a visitor to Halifax, Nova Scotia, in the maple sugar season will visit the green market and hunt up the Micmac Indians, he will be very likely to find for sale by the women sitting on the curbstone little birch bark cornucopias filled with maple wax.

The early settlers in northern New England were very grateful for the production of the maple, and they had no other sweetening material, for in those remote settlements such luxuries as sugar imported from England were all but unknown.

The industry of manufacturing maple sugar for the market has been one of very marked development. The same progress in the way of perfection of methods from the tree to the commercial use in the city has prevailed in connection with the maple sugar business as with other industries.

The process begins with the tapping of the tree. The opening of the season, or the season when the sap flows freely, varies according to weather conditions, from early in February until some time in March, and whatever time the sap may begin to run it continues not much later than the first day of April, and but a few days later at the most. The conditions favourable to a good maple production season are plenty of snow, warm, springlike days and cold nights. The snow should thaw enough to make little rills of water here and there during the day, and it should freeze during the night hard enough to form a crust that will bear people, and often it will

support ox teams. The running of the sap will continue as long as these conditions last, and not much longer.

There are three principal kinds of maple in the country where the industry flourishes. There is the rock maple, which is the true sugar maple, the white maple, which is an upland maple producing sap, but the sap carries a small proportion of sugar, and the swamp maple, the sap of which also carries a small percentage of saccharine matter. Years ago, before modern methods were introduced in the maple sugar and syrup business, the trees were tapped in a very wasteful manner, and in a manner which permanently injured the trees. The farmers of those days apparently had an idea that the larger the hole bored in the tree the more sap would flow, so they bored holes with two-inch augers and nearly or quite to the heart of the tree. Such a thing as plugging the holes after the sap was done running did not occur to them, and, of course, while the holes did in many cases heal over, a cavity was left in the interior of the trunk which began the process of decay, and many fine old rock maples of great age have come to their end as a result of the lack of knowledge of those who tapped them for their sap. As intelligence increased in connection with all industries, it was known that the sap which flows upward in the spring passed up between the outer wood of the trunk and the inner bark, and all that was necessary to secure it is to bore through the bark and far enough into the wood to allow the spile to be driven in securely. The spile is the conductor of the sap from the tree to the receptacle placed to catch it. Nowadays the holes are bored with small augers or bits, and not very deep, so that the process of tapping trees as practised at the present time injures them very little or none at all.

In the old days spiles were made of wood, sometimes of pine wood with holes burned through that portion driven into the tree, but usually they were made of the wood of the sumac, a beautiful golden yellow wood, having a straight grain, and through the centre, no matter what the size of the branch or trunk, a core or pith which was easily pushed out. Instead of buckets and pails used to-day for catching the sap, the old-time farmers used troughs hollowed from the halved section of poplar trees. The sap was gathered and either conveyed to the farmhouse, where either in the farm kitchen or in an outbuilding, it was boiled down in open kettles, or it was collected and conveyed to a shanty built in the sugar grove, where it was boiled down, also in open kettles. The sugar made by the old-time farmers showed a little more crystal than did that of the Indians, but it was always dark, perhaps we should say it was always dark of different shades. The syrup was the chief product manufactured. The sugar was made into cakes by running it when hot into cups that had been lightly glazed with butter or lard. This, in brief, is the sum total of the process of making maple sugar and syrup in the old days by the farmers of New England.

We have mentioned the innovations in the method of tapping, that is, of boring trees. To-day specially made metallic spiles are used which can be driven in so firmly that the buckets for receiving the sap can be suspended from them if desirable. The same innovations have been adopted in the manufacture of syrup from the sugar cane. Instead of the open kettle of the old days in Vermont sugar makers now evaporate their sap in vacuum pans, which is not only economical, but very much more expeditious, and which turns out sugar as light-coloured as the lightest so-called brown sugars of the sugar cane. Of course it is understood that the vacuum pan is just what its name implies. In it the sap is boiled in a vacuum, whereby it evaporates with great rapidity, and with a considerably less degree of heat than is required by the open kettle process. The superiority of the vacuum pan process is indicated by the appearance and quality of the finished product. On some of the sugar farms in Vermont there are many thousands of trees. These trees may be collected in groves standing near together, and they may be scattered over a wide area. They may be scattered among other forest trees or standing singly over wide ranges of pasture or mountains and hillsides, for a great rock maple standing alone in an open pasture is never neglected by the sugar maker for the very isolation of its position and the consequent conditions surrounding it make it always a big producer of sap. On these large sugar farms there is somewhere conveniently located a sugar house, where are installed the vacuum pans and such other apparatus as is necessary in the making of the sugar. The sap is collected once or twice a day, according to how freely the trees run. This is determined not only by the tree itself, but by the season and by the day itself, for if the day continues cold, that is, if there is a cold wind blowing so that the sun does not melt the snow, th

sap will run very little. It will not run freely on a dull, cloudy day. If the day is perfect and the conditions which we have mentioned above prevail, the sap will run not only drop by drop, but almost in a steady stream from many of the trees. Under these conditions it is necessary to collect the sap at noon and again along towards night. In a grove of trees where the maples stand near together, sometimes long spout or pipe lines as they might be described, are arranged on forked sticks or fastened from tree to tree leading from certain points in the grove to a vat in the sugar house. The sap is collected and poured into spouts or pipe lines, which greatly facilitates the collection of it. The sap is also collected in barrels and hauled to the sugar house on horse or ox sleds.

There is no more interesting or fascinating season in northern New England than the season of maple sugar making

In recent years the industry has become such a leading one that the manufacturing of maple products is carried on with the greatest intelligence and scientific knowledge. There are certain standards that have been adopted, and that are generally recognized in the business, and there are certain conditions and rules regulating the business and the marketing of the product. Vermont has enacted wise laws applying to the purity of maple products, and the centre of inspiration of everything applying to the maple sugar business, from the tree to the store and the city commission merchant, everything which tends to preserve the industry with all its high reputation in Vermont, is the Vermont Maple Sugar exchange.

Maple sugar sold in the Boston market has a guarantee of purity, and the only reason worth considering for the difference in price is a slight difference in quality and colour. The finest grades are in cakes and come packed in neat cartons. The lower grades of soft sugar are shipped in kegs. Syrup is shipped in tightly sealed screw-top tin cans or cases.

We conclude this narrative by alluding to a favourite pastime or entertainment during the maple sugar season which may not be familiar to everybody. It is known as sugaring off, and is very much in vogue in Vermont, New Hampshire, and in Boston by the New Hampshire and Vermont associations. But as practised in the city it is a tame and a make-shift affair at best. We have in mind one celebrated hotel in New Hampshire which is both a summer and a winter resort. It is about as well-filled with guests in the winter as it is in the summer, and at both seasons people are constantly turned away. In the winter, beside the crisp, health-giving and healing air, it offers as inducements its open wood fires and sugaring off parties. Sugaring off parties begin in this wise: Maple syrup which has been boiled down almost to the point of crystallization, just before it passes from sugar to syrup, is placed over the fire. Just at this period the process is very interesting and very fascinating to those who have the privilege of participating in it. In the great kitchen of this hotel blocks of snow are placed on long tables, and from time to time the hot, thick syrup is taken from the kettle and poured upon the snow. It is quickly cooled, and at first changes to soft wax. This is a very delicious form of confection, and of course the flavour is incomparable. After a little time more syrup is dipped from the kettle, and this time perhaps on cooling it is a little harder. Again, the process is repeated, and after cooling the product is found to be a soft sugar just at the stage of crystalization, but yet scarcely beyond the syrup stage, and so the dipping and cooling goes on unti the syrup has become real sugar, and until the company are satisfied, or until the supply gives out.

VANILLA CROPS, 1910-11.

(From the *Chemist and Druggist*, No. 1,638, Vol. LXXVIII., June 17, 1911.)

Mr Herman Mayor Senior has issued his annual vanilla statistics, showing that the world's production for the season 1910-11 amounted to 570 tons. The characteristic feature of the vanilla market during the past twelve months has been an unusual evenness of strength throughout which culminated last February in a basis of 13s. 6d. per lb. for sound low-grade Bourbon or Seychelles varieties in the primary market, and this figure has been fully maintained since, with better qualities at correspondingly higher rates. Short crops in the 1909-10 season, with practically no stocks taken into the new, have in a natural way caused this firming up, and so eager has the American inquiry for Bourbon sorts been, that for the first time in all experience their value temporarily surpassed that of Mexican. The latter have since advanced as well, and meet with an increasing European demand, chiefly on the part of France,

in which country a new Pure Food Act on lines similar to the American one, combined with the general shortage of other descriptions of vanilla, has lately stimulated this demand.

Looking upon Tahitis and also Mexicans from the British trade standpoint as outside varieties, chiefly on account of their localised outlet, and in the case of the latter also on account of their appearance at trade centres quite six months after the bulk of the crops from the Indian Ocean Islands have come in, we find, by deducting their returns from the total, a year's yield of 195 tons of vanilla, against 140 tons in 1909-10, a considerable increase, but still about 25 per cent. below a normal year's average from the same sources, on which Central and Western Europe are almost entirely, and the United States partly, relying for their supplies.

The various crops have been :—

	Tons.
Seychelles	22
Bourbon	45½
Comoro and Mayotte ...	52
Madagascar	55½
Mauritius	3
Fiji, Java, and Ceylon ...	7
Guadeloupe and Martinique	10
Mexican	135
Tahiti	240
Total	570

The outlook for new season's Seychelles is poor, for Bourbon, Madagascar, and Comoro fair, and for Mexican good.

INDIAN MANGO JUICE.

We have received from the Oriental Cannery Co., Honovar, India, a sample tin of this preparation of which we have formed a very favourable opinion. It is of semi-solid consistency, and the colour and taste that of the best ripe mangoes. It is excellent served as a sauce with blanc-mange, etc., and could also be used to make ices, or simply mixed with milk to form "mango fool," or used alone, in place of mango fruits, for dessert.

According to the report on it from the "Lancet," it is stated to be practically free from sugar, and to possess anti-scorbutic properties, while the British Medical Journal states that it is free from preservatives, and the material appears to consist of nothing but the pure pulp with its natural juice.

It can therefore be confidently recommended as a very satisfactory means of enjoying the mango fruit at any time or place.

THE RULE OF THUMB IN SUGAR MAKING.

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLVI., No. 17, April 29, 1911.)

In what the survivors of that long departed epoch may term ancient times – that is before the era of chemical control generally in the operation of our Louisiana sugar factories—the most satisfactory results in the quality of product were often obtained by professional experts profoundly ignorant of the scientific principles they followed which led to the final accomplishment of their most excellent work, and often unlearned in the rudiments of a common school education.

The writer of this article has, during several successive years, seen a densely ignorant negro make good sugar throughout the rolling season without comprehending the special operation of a single one of the several valves of the vacuum pan he attended in turning out such good work. Likewise unlearned operatives at the ancient open clarifiers and the still more ancient open kettles, without the least understanding of the chemical principles of sulphuration and the alkaline effect of the lime which neutralized the excess of mineral acids and the normal vegetable acids which held the albumen and other deleterious compounds in solution, have been noted for reliably producing throughout the sugar manufacturing that practically perfect clarification which is the indispensable foundation in the art of making the finest quality of sugars.

In those ancient days the salaries of some of our deservedly famous Louisiana sugar makers, who worked, one might say, by a sort of seventh sense of judgment, or through some incomprehensible talent, and the simple rule of thumb, exceeded for the two or three months of the sugar making season those per month paid the members of our National Cabinet or the Judges of our United States Supreme Court. And in justice to those latter operatives or experts we may say they fairly earned the high wages for their work; as their ability was exceptional and its practical results extremely profitable to their fortunate employers, the sugar of whose factories often became famous in the leading markets of the country.

That chemical control soon destroyed the opportunity or professional career of most of those gifted followers of the laws of practical experience, the sense of individual judgment and the rule of

thumb, is generally known by all persons in this state who are interested in the growing of cane and its conversion into marketable sugar, and most fully known and emphatically appreciated by the most of those experts who were not permitted to continue their work under the guidance of their own unhampered resourcefulness.

Chemistry promptly stopped the excess of sulphuration which bleached the cane juices to the degree desired for the manufacture of fancy grades of sugar, in which it demonstrated that quality was gained at too great a sacrifice of quantity. It increased the liming of cane-juices almost to or entirely up to the point of acid-neutralization tinting the formerly clear and colourless clarified juice with a touch of straw colour, and darkening it progressively and steadily in concentration and ultimate concreting into massecuite, until its dried product bore the dull gray colour due to alkalinity, and its final molasses was made to figure commercially as black-strap.

The surviving experts of that epoch of the rule of thumb in our local sugar industry mostly charge that the modern deterioration in the grades of the major portion of our Louisiana sugar crops is due to that struggle for quantity at the cost of quality; thus reversing the charge made against them by chemists that their excellence of quality was gained at the wasteful sacrifice of quantity.

To an experienced observer both those charges and counter-charges were and are based on reasonable grounds. Had the former sugar-making experts been more familiar with chemistry, and its actions and reactions, probably they would have done much better in their particular line of business. Perhaps if the modern chemical managers who have supplanted them in the control of the operations of our central factories would cultivate and acquire more of that incomprehensible seventh sense founded on practical experience which our out-of-date sugar making experts appeared to possess, it would be to the marked advantage of general chemical control of the sugar factories.

Whatever be the case and condition it is a fixed and incontrovertible fact that the certainty of chemical principles is more to be depended on than the variations of human judgment. Those principles are guided and governed by the immutable laws of natural physics, as fixed and unchangeable as the grand universal law of gravitation which guides the movement of every known solar and planetary system; while erratic human judgment might be just not sufficiently erratic to be governed by the laws of a lunatic asylum.

With this known certainty and reliability of chemistry and its principles, it is up to chemistry in a mechanical art in which it plays so important a part to do far better than the mere guesswork of human ignorance and unlearned human judgment. That is it is up to it under erudite and intelligent direction. If a plantation darkey could guess how much sulphur and lime to use on the expressed product of a ton of cane and make a quality of sugar which levee-buyers would scrap over to purchase, but do it at the cost of quantity of product, then chemistry or chemical control of the same sugar manufacture should surely be able to achieve the first desirable result, and at the same time remedy the evil which made or makes such rule-of-thumb work sacrificial.

That chemical control since its installation has very largely increased the average yield per ton of cane in our Louisiana sugar factories goes without saying. The writer of this article remembers the time about twenty-five years since that when an able chemist who had charge of one of our Louisiana sugar houses claimed to have obtained 150 pounds of sugar per ton from a cane crop whose manufacture he had superintended, he was considered by many of our leading planters as being very largely lacking in veracity. A year or two later Mr. Thompson's noted Calumet plantation pulled the sugar yield from an entire crop to about 200 pounds per ton of cane. And to-day the factory that does not get more than 150 pounds of sugar per ton of cane ground is deemed out of the running and doomed to ultimate failure.

Chemical control has done wonders in increasing our sugar yields beyond the utmost aspirations of the experts who strove after quantity in their departed epoch. Now it is promising to give us generally a co-equal gain in quality, which as an exact science it should be able to do better than the inexact direction it generally supplanted two or three decades since.

THE SUGAR MAKING INDUSTRY IN INDIA.

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLVI., No. 17, April 29, 1911.)

India is the greatest cane sugar-producing country in the world, but notwithstanding this fact, its sugar market has been captured first by the beet sugar, and later by cane sugar from Mauritius and Java. This condition of affairs has been brought about by the backward state of the Indian sugar cane industry in the matter of machine appliances. It is estimated that with modern machinery and better organization of the industry, India could produce 50 per cent. more sugar. Sugar cane is a crop particularly well-suited to the country, and, in the matter of sugar production, India ought to be an exporting rather than an importing country. The native mills are, according to the American Consul in Bombay, either the "kolhu," a mortar and pestle arrangement, in which the cane is bruised and pressed, or else wooden roller mills, of which there are two kinds—the "gundi," consisting of two, sometimes three, upright wooden rollers, and the "belna," used in the Punjab, and made of two horizontal wooden rollers. These mills are made locally at a cost of from twenty-six to forty shillings. They are hard to work, and do the pressing very ineffectually. In many parts of India these old, clumsy wooden mills are being replaced by the iron sugar mill. This improvement, however, was only effected after a close study had been made of native ways and requirements, and after the machines had been adapted to these. The cultivators had experienced a great deal of trouble in procuring an efficient machine for crushing purposes, as, owing to their lack of knowledge about machinery, the imported machine soon got out of order, with the result that the cane was imperfectly crushed. Most of the sugar produced in India is consumed in the form of "gur," or unrefined sugar (corresponding to the "Muscovado" of the West Indian planters), because of its adaptability to native sweetmeats and native cookery. The establishment of large central factories has been urged as a means of increasing the sugar yield of the country, and meeting the formidable competition of the imported article, Although there are a few factories of considerable size, most Indian cane is grown and manufactured by small cultivators. Under present conditions the large central factory is hardly practicable. The system of land tenure which obtains practically throughout the country is not adapted to such a system. The soil is divided into a number of small holdings, which produce a variety of crops, according to the fancy of the cultivator. It is practically impossible, therefore, to secure a concentration of sugar plantations around a factory, and so long as cane is only grown in small and isolated patches through a radius of many miles, the cost of handling and carriage, added to the loss of sugar in transit, handicaps the factory so much that success is out of the question. The portable iron mill, therefore, has been more practical, the cheapness of Indian labour counterbalancing the economies practicable in the large central factories. About half the sugar cane produced in India is grown in the United provinces. The American Consul states that Mr. W. H. Moreland, Director of Land Records and Agriculture, Lucknow, has given much time and attention to the study of the Indian sugar industry, and would, the Consul believes, be interested to learn of any new crushing machine which would be adaptable to the needs of the Indian cultivator. It is often through the agricultural departments of the various provinces that such things are brought into the country. It is not easy to introduce an article of this description into India, and unless firms are prepared to go to a good deal of trouble, and perhaps some expense, in learning the exact needs of India in respect to such machines, it will be useless to make any such attempt.

DOMESTIC RICE CULTURE INCREASES RAPIDLY.

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLVI., No. 17, April 29, 1911.)

The United States Department of Agriculture has completed a report on rice culture in the United States in which, after an elaborate technical survey of the subject, the Department calls attention to the great changes in the methods of cultivation as follows :—

"In 1884 and 1885 a few farmers from the North-western prairie States settled on the great southern prairie which extends along the coast from the parish of St. Mary in Louisiana to the Texas line about 140 miles. Finding that rice, which had been grown for many years for home consumption, but by Oriental methods, was well-suited to conditions of agriculture here, they commenced

immediately to adapt the agricultural machinery to which they had been accustomed to the rice industry. The gang plough, disc harrow, drill and broadcast seeder were readily adjusted, but the twine binder encountered a number of serious obstacles. However, by the close of 1886 the principal difficulties had been overcome. Wherever prairies were found sufficiently level, with an intersecting creek which could be used to flood them, they were surrounded by a small levee thrown up by a road grader or by a plough with a strong wing attached to the mold-board, extending it four or five feet. These levees were usually twelve to twenty-four inches high, and the interior ditch was twelve to eighteen inches deep and four or five feet wide. Very few interior ditches were made for drainage. The land was so level that fields of forty and eighty acres were common. Large crops were produced. The prairies were practically free from injurious grasses, and the creek or river was soft and bore no damaging seeds to the fields. The rice fields were handled like the bonanza wheat farms of Dakota, and fortunes were made. Levees were cheaply constructed; little attention was paid to drainage, more than to remove the surface water; shocking, stacking and threshing were done in a very careless manner; the main object being apparently to plant a large acreage and harvest a certain number of bushels regardless of quality. Ultimate failure was certain, but it was hastened by drought. A succession of dry years followed. The creek failed and reservoirs were found to be expensive and unreliable.

"The soil and climatic conditions in South-eastern Texas are almost precisely like those in South-western Louisiana. Rice culture in this section requires no separate treatment. What is applicable to the one applies also to the other. There is a belt of prairie land well-suited to rice extending from the Sabine river west for 250 miles or more along the coast. Within a few years large farms have been opened and devoted to this cereal with excellent returns."

On speaking of the prospects of the industry the Department says:—

"The outlook for the further extention of rice culture is very promising. According to the best estimates there are about 10,000,000 acres of land in the five States bordering on the Gulf of Mexico well suited to rice cultivation. The amount which can be successfully irrigated by present methods, using the available surface and artesian flows, does not exceed 3,000,000 acres. The balance of the land could probably be brought into cultivation were it necessary, but the cost would, perhaps, be prohibitive at present prices. Three million acres is a conservative estimate of the area which can be easily irrigated. The best results require rotation of crops; consequently only one-half of that area, or 1,500,000 acres, would be in rice at any one time. At an average yield of 10 barrels (of 162 pounds) per acre, 1,500,000 acres of rice would produce nearly 2,500,000 pounds of clean rice, nearly six times the amount of our present consumption. There is no satisfactory reason why the United States should not grow and mill all of its own rice and become an exporter.

"The employment of machinery in the rice fields of the South-west similar to that used in the great wheat fields of California and the Dakotas is revolutionizing the methods of cultivation and greatly reducing cost. The American rice grower, employing higher priced labour than any other rice grower in the world, in all probability will ultimately be able to market his crop at the least cost and the greatest profit. If, in addition, the same relative improvement can be secured in the rice itself, and if varieties which yield from 80 to 90 per cent. of head rice in the finished product can be successfully introduced, American rice growers will be able to command the highest prices for their product in the markets of the world."

PLANT SANITATION.

THE DEGREE OF VIRULENCE OF FUNGUS ATTACKS.

(From the *Agricultural News*, Vol. X., No. 234, April 15, 1911.)

In these days, when almost everyone connected with agriculture has had a considerable, and often unpleasant, experience of the general effects of fungus diseases on crops, it is hardly necessary to point out that some fungi are much more thorough than others in carrying out their work of destruction. It is only requisite to consider for a moment the damage inflicted upon the sugar-cane in the West Indies by the rind fungus during the last decade of

the past century, and to contrast it with the comparatively small annual toll exacted by the root fungus of that crop, or by the pod diseases of cacao, in order to realize fully how different may be the effects produced. In the first instance, the colonies were threatened with the complete annihilation of their staple industry; while, with the other two, though the yield is reduced to a greater or less extent by the parasites, some return may always be expected from the crops.

Since the attacks of endemic fungi, such as those causing pod diseases of cacao, are much less immediate in their economic effect, and consequently of a considerably less alarming nature to the community in general, ample time is afforded to the mycologist in which to perfect his means of combating them, and to the practical agriculturist in which to realize the importance of such means and to apply them to his crops. Moreover, endemic fungi are frequently in their nature more easy of control than the epidemic. The majority of plant diseases are of an endemic nature, and this fact, taken in conjunction with their extended scientific study, has resulted for the greater part in the formation of fairly efficient means for reducing the damage they inflict, and the recognition of the nature and importance of these diseases has called into being a body of men specially trained in the knowledge of this subject.

Now, since common experience has shown in many cases that such trained men are able to give advice which, if followed, will result in the extensive reduction of the losses formerly incurred owing to the attacks of parasites, a natural belief is tending to arise that mycologists can always afford advice of a simple kind for controlling or eradicating all fungus diseases. In reality, this is far from being the case. Much depends on the nature of the host plant, on general external conditions, and on the co-operation of large numbers of persons whose crops are attacked by any given disease. Even then the position may appear almost hopeless, and may only be saved by the intervention of some unforeseen external circumstance. A good illustration of what is meant is afforded by the outbreak of canker on the chestnut trees of the United States, which only attracted attention in the year 1904, and has now become a serious epidemic, so far impossible to control.

The disease is due to a wound fungus identified as *Diaporthe parasitica*, Murrill, which lives in the inner bark and cambium of the stem and all woody branches of the chestnut. On limbs with smooth bark, the parasite produces pale brown, sunken patches on the outer bark. These become more or less thickly covered with the yellow orange or reddish brown pustules of the fungus, which break through the lenticels. In a damp atmosphere, the summer form of spore is extruded in a yellow or greenish tendril, which becomes brown as it grows older. The fungus grows so fast that it can completely girdle a branch or small trunk, and thus kill it in from one to two years. Even large trunks are girdled as a rule in four years.

The native American chestnut (*Castanea dentata*) is the plant most subject to attack, but the chinquapin (*Castanea pumila*), found native from New Jersey to Florida, is also affected, while the disease has been found, as well on the Japanese chestnut (*Castanea crenata*). Indeed, it is suggested that imported plants of this foreign variety growing at Long Island may well have served as the original source of the disease. This point has not, however, been definitely established.

Instances of a disease which may have been this were noted as early as 1902, but it was not until 1904 that it attracted attention; while it did not receive full investigation by a mycologist until 1905. At that time it had assumed serious proportions, and by 1909 over fifty per cent. of the trees within a radius of twenty-five miles of New York had been completely killed out. In addition to this, the disease had appeared at various points in a number of states, and its rapid spread throughout the whole of the chestnut and chinquapin-growing area of the United States appeared imminent. Another very serious consideration was that all the preventive measures tried within the area of serious infection had failed absolutely to produce any effect, though these had been carried out on a fairly extensive scale by trained men, and though support was given to the work by the United States Department of Agriculture. There was, moreover, no lack of co-operation on the part of individuals, and no want of money. Everything possible was done in many instances, but absolutely no result was achieved. At the present time, practically every tree within the infected area is doomed, while the possibility of the complete destruction of the native American chestnut and of the chinquapin must be faced. It is needless to state that this destruction represents a loss of economic products aggregating in value several hundred million dollars.

Metcalf and Collins, writing in 1909, took a less gloomy view of the situation. They believed that the spread of the disease could be restricted to the badly infected area, if stringent measures were adopted with this object. These measures included the most careful inspection of all nursery stock and the passing of very thorough quarantine laws in all districts at that time free from the disease. Furthermore, they stated that the Department of Agriculture was prepared to give all possible assistance, particularly in educating the public to recognize the disease, so that trees recently infected in a previously healthy area could be removed, and diseased parts burned. In such an area, where the sources of reinfection were small, very careful excision of diseased parts might also prove effective. Even then, they advised that constant vigilance would be necessary. Spraying experiments with infected trees were inconclusive. In the badly infected area, the complete destruction of diseased trees was recommended as the only course to be adopted, since the sources of reinfection were so numerous as to preclude the possibility of successful treatment. It was also suggested that, subsequently, replanting with a partially immune variety, such as the Japanese chestnut, or with a cross between this and the native species, might be found possible, though the Japanese tree does not yield such good nuts, and does not appear to be as nearly as useful as lumber.

No disease as destructive as this has ever yet been experienced in the West Indies. The sugar industry was fortunately saved by the discovery of comparatively immune varieties of cane, giving returns as good as, or even better than, the variety destroyed. Nevertheless, the experience of the United States in the instance quoted indicates that an outbreak of disease might occur on any crop, which could not be checked by the most skilful treatment or the most thorough co-operation, and that nothing would remain but to face the consequences and to adopt the cultivation of some different plant.

CHEMICAL PROCESS TO PRESERVE TIMBER.

WOOD BOILED IN SACCHARINE SOLUTION —PROCESS CLAIMED TO BE SIMPLE AND INEXPENSIVE.

(From the *Manila Bulletin*, June 5, 1911.)

A limited stock company, located near Wellington, New Zealand, is now engaged in treating chemically lumber of ordinary quality for railroad ties, fence posts, etc., and claim is made that the material so treated will last as long as the best wood the forests can produce.

According to a New Zealand journal, the company has established extensive works capable of treating a million feet of lumber per month, and yet is quite unable to cope with the rush of orders received.

In reporting on the new process, Consul-General W. A. Prickitt says:—

The preserving process is said to be simple and inexpensive, and consists essentially in boiling the wood in a saccharine solution to which certain other substances are added according to the special purpose for which the lumber is required. The lumber is not subject to any external pressure or vacuum at any stage of the process. The wood as it is received is immersed in a cold solution in large open tanks. This solution is gradually raised to the boiling point and is maintained at this temperature for a certain time, depending on the size and density of the wood. After cooling the wood is removed and placed in a drying chamber, the temperature of which is slowly raised. When sufficient desiccation has taken place the chamber is gradually cooled down. The time occupied of the whole treatment generally takes but a few days, though in special cases and for large-sized timber it may be extended for several weeks. The action which takes place is described as follows:—

As the temperature of the solution in which the wood is immersed is raised the air in the wood expands and the greater portion escapes in a series of bubbles. As a saccharine solution boils at a slightly higher temperature than water, the moisture in the wood is converted into vapour and escapes along with the air. During the boiling the albuminous matter in the wood is coagulated and rendered inert. In some measure this coagulation accounts for the strength of the wood being increased by the process. While cooling the solution is rapidly absorbed by the wood and penetrates every part of it.

The company is executing an order for 180,000 sleepers for the Government Railway Department, and the works were lately inspected by the Prime Minister. The company is also treating large quantities of wood for use in railway cars and carriages.

Among the advantages claimed for this process is the statement that the timber can be treated as soon as it is brought in from the woods and then

immediately used for the purposes required, whereas in the ordinary way the sawn timber must be allowed to season for a year or more before being worked up. It is claimed, also, that there is no waste in lumber which has been treated, as the process stops all warpage and splitting, as well as rendering it absolutely immune from dry rot and borer insects.

LIVE STOCK

BRIEF REPORT ON THE VETERINARY INSTITUTIONS OF JAPAN.

By R. F. KNIGHT,
Assistant Chief Veterinarian,
and
C. G. THOMSON,
Superintendent of the Serum Laboratory.

(From the *Philippine Agricultural Review*, Vol. IV., No. 3, March, 1911.)

ORGANIZATION.

The veterinary work forms one of the divisions of the bureau of agriculture, which is under the administration of the Minister of Agriculture and Commerce, and to it are assigned the inspection of meat, the inspection and quarantine of imported animals, and the control of contagious and infectious animal diseases. Although the improvement of equines is left entirely in the hands of the military department, the remainder of the animal husbandry work comes within the field of the bureau of agriculture, and so much has been done along this line by the importation of foreign stock that in some localities it is difficult to find an animal of pure Japanese blood. Numerous publications pertaining to the veterinary work and organization have been issued in the form of pamphlets and compilations.

RINDERPEST ERADICATION.

The work of the eradication of rinderpest in Japan by the bureau of agriculture is greatly facilitated by existing provisions, not only for the slaughter of animals affected with this disease, but also for those suspected of being infected. Quarantines are maintained against the districts where disease prevails by an efficient police force in such a manner that there is little danger of the extension of the area infected. As a matter of fact, however, the Japanese people have such a hearty respect for law and order that there are few attempts to violate any quarantine regulations that are imposed.

In addition to the slaughter of the animals affected and those directly exposed, and strict quarantine over the infected locality, the injection of anti-rinderpest serum is practised upon the neighbouring animals which are not known to have been directly exposed to the disease. The Japanese officials believe that anti-rinderpest serum is valuable in stamping out an epizootic of rinderpest, and that in the majority of cases a dose of 100 cubic centimeters can be depended upon to confer a passive immunity to the average animal for a period of two or three weeks. It appears that their conclusions regarding the value of anti-rinderpest serum have been drawn principally from literature. They use serum largely on those individuals which they believe are not exposed and where they do not expect the disease to appear. The fact that they do not have a large number of cases among animals that have been injected with anti-rinderpest serum seems to be due to the fact that very few of the injected animals are actually exposed. Their tests regarding the efficiency of this serum have been, so far as could be ascertained, the simultaneous injection of serum and virulent blood. It is believed that the simultaneous injection of large doses of serum will greatly reduce the percentage of mortality in animals that are given virulent blood, but this does not prove that the injection of anti-rinderpest serum will prevent an attack when an animal is exposed several days after the injection of serum. However, some of the Japanese, especially Dr. H. Tokishig, Superintendent of the Institute for the Infectious Diseases of Animals, believe the injection of anti-rinderpest serum to be of little value except when used in connection with other measures, such as the slaughter of infected individuals and those directly exposed, strict quarantine of the infected district, etc. During the past few years outbreaks of rinderpest in Japan have been largely due to the importation of disease from China and Korea. On several occasions they have suffered from small outbreaks which have been

traced to these sources, but these outbreaks have been speedily suppressed by stringent measures, and the country has remained free from rinderpest until another importation of the infection. Japan suffered its heaviest losses from rinderpest in 1896, for which year about 7,000 deaths are recorded. This infection was stamped out during the same year, and no new cases appeared until 1899. Since then the disease has appeared from time to time through importations received from the mainland, but it has never seriously menaced the livestock industry. At the present time Japan is entirely free from rinderpest, and to prevent the importation of contagious and infectious animal diseases the Government has installed quarantine stations at the principal ports, and has issued stringent regulations governing the inspection and quarantine of animals received from foreign countries.

QUARANTINE STATIONS.

One of the quarantine stations, that at Yokohama, was visited. It is small, accommodating only about 50 animals, but as practically no animals except those for breeding purposes are imported at Yokohama, it is of sufficient size for that port. The quarantine station is located about 5 miles from the central part of the city and is situated on a small inlet so that live stock can be transported directly from the steamers to the place of quarantine.

The entire station occupies about three-tenths of a hectare of ground, and is surrounded by a tight board fence about 3 meters in height. In the centre of this area is a building of two stories which is used by the quarantine officials as an office. Around this central structure are several other buildings used for the detention of animals. These buildings are constructed along sanitary lines having concrete floors and electric lights. They are well ventilated and offer ample room and comfortable accommodation to the animals. Some of these buildings, those used for the detention of animals which may have been exposed to any of the diseases which are most commonly transmitted by flies, are provided with double screen doors and windows. In addition to these structures there is a small building located in one corner of the grounds for the isolation of suspected cases of disease, and another similar building which is used exclusively for post-mortem work. Bovines and other animals susceptible to rinderpest, imported from foreign countries where rinderpest is known to exist, are held at this quarantine station for twenty days after their arrival. In case rinderpest develops among any of the imported animals during the period of quarantine the entire herd is slaughtered and without indemnity to the owner. These regulations do not apply, however, to cattle imported for slaughter, as these are held in quarantine for two weeks only, after which time they are required to be slaughtered within three days.

SLAUGHTER-HOUSES AND MEAT INSPECTION.

The cattle dealers and butchers are required to furnish men for slaughtering their animals, and they are charged a moderate sum for the use of the abattoir (for cattle and horses, 1 yen* per head, and for hogs, 25 sen). The buildings connected with the Government abattoir at Tokyo cover about one-fifth of a hectare of ground which is inclosed by a board fence. On two sides of this enclosure are sheds for tying animals which are awaiting entrance to the slaughter-house. The hours for slaughtering are from 5 a.m. to 10 a.m. There is daily inspection before killing commences of the clothing worn by the men working at the slaughter-house and of all baskets and other utensils.

The Government inspection of meat consists of a careful ante-mortem inspection of the animals and a thorough post-mortem examination of the carcass. The ante-mortem inspection is conducted in a shed which is near the entrance of the main building and equipped with scales for weighing the animals. Near this shed is a building used as an office for the veterinarians and police officers in charge, and at one end of this latter structure is a laboratory sufficiently equipped to enable the veterinarians to make a microscopical examination of the abnormal tissues revealed by the post-mortem examination. This laboratory is supplied with glass jars and preservatives for the collection of interesting pathological specimens which are occasionally encountered.

The main structure, where the butchering is performed, has a concrete floor with deep grooves running in two directions so that the fluids are carried into the main gutters without spreading over a large area of the floor. The walls to the height of $1\frac{1}{3}$ meters are enamelled tile. About one-third of this building is partitioned off for the dressing of cattle. These are skinned on the floor, and then by means of men and tackles, are hoisted to a track where they are eviscerated. A post-mortem examination is made in this room, and

* 1 yen = P 1; 25 sen = 25 centavos.

if no pathological lesions are found, the carcass is stamped and passed for food. If any abnormalities are revealed, the carcass is run into a separate room for a final examination and the viscera are carried into another room where they are placed upon a table and given a thorough examination in order to ascertain whether or not the carcass or any of its parts are fit for human consumption. A room adjacent to the main killing floor is devoted entirely to the cleaning of viscera. Hogs are slaughtered on the opposite side of this building and go through the same system of inspection as the cattle. Horses and other animals are occasionally slaughtered, but cattle and hogs form the principal means of supply. Condemned carcasses are taken from the slaughter-house to the crematory, while condemned parts, such as lungs, livers, etc., are rendered sterile by boiling at the slaughter-house and then used for fertilizer.

The Government slaughter-houses are under the supervision of the Police department, and the stamps with which the quarters are marked bear the words "Inspected by the chief of the Police Court." The bureau of agriculture inspects the meat and decides whether or not it is fit for human consumption. The remainder of the work at the abattoir is under the supervision of the Police department.

The inspection of meat is very thorough, and all meat imported into the Philippine Islands bearing the stamp of the Japanese Government may be considered fit for human food unless affected by decomposition or other changes which have taken place after the inspection. At the Government abattoirs in Japan, a great many parts are condemned on account of the presence of animal parasites. Among those more frequently found are the *Echinococcus*, the *Strongylus Paradoxus*, and the *Distoma hepaticum*. The first of these often produces in the lungs a marbled appearance, which on microscopical examination somewhat resembles a lung affected by contagious pleuro-pneumonia. The last of the three mentioned is very common, and when this parasite is found the entire liver is condemned. Aside from the parasitic affections, tuberculosis is one of the diseases most frequently discovered. This disease is quite widespread in Japan, and the Government has taken important steps toward its control.

Institute for the Infectious Diseases of Animals.

In connection with the control and eradication of animal diseases, the bureau of agriculture maintains at Tokyo, under the direction of Dr. H. Tokishige, a laboratory well equipped for experimental work and the production of serums and vaccines. The scope of its work is indicated by the following table showing the quantities of various preparations there during the year 1909 :—

Anti-rinderpest serum ...	liters	400
Anthrax serum ...	do	151
Anthrax vaccine ...	do	5
Tuberculin ...	do	33
Mallein ...	cubic centimeters	725
Chicken cholera vaccine ...	liters	40
Swine erysipelas serum ...	do	2·5
Anti-strepticocci serum ...	do	29

The preparation of serum for hog cholera and backleg is being commenced, but up to the present time very little has been produced.

All the animals at the institute are inclosed in the same yard, so that great precautions are necessary to prevent the spread of the different diseases from one stable to another. For this reason animals are kept in fly-proof sheds which are so constructed as to readily permit a thorough disinfection. The unnecessary passage of attendants from one building to another is prohibited, and all persons entering any part of the grounds, except the laboratory proper, are required to wear rubber boots which are immersed in antiseptic baths upon leaving any of the buildings. The institute covers about one hectare of ground, and is inclosed by a high fence. About thirty-five animals are used in the production of anti-rinderpest serum, besides a few others which were being held as virus carriers.

The general method of the production of anti-rinderpest serum is very similar to that which is being practised in the Philippine Islands, but the process of immunization is a trifle slower. The animals are bled twice during a period of three days about two weeks after the inoculation of 700 or 800 cubic centimeters of virulent blood. No rules are laid down as to the number of bleedings which each animal is to undergo, but the treatment of individuals depends greatly upon the need for serum, the amount of virus available and other factors. As a rule animals are discharged after the second bleeding following inoculation of 3,000 cubic centimeters of virulent blood. The men in charge of this work claim that larger

doses of virus do not give a corresponding reaction, but tend to be destroyed rather than absorbed. They maintain that the serum animals may be used for the production of serum indefinitely without any reduction in the potency of the serum produced. After being placed in stocks the animals are bled from the jugular vein by means of a trocar and canula, the blood being received into a cylindrical glass jar about 10 or 12 centimeters in height and of a capacity of about 400 cubic centimeters. After the blood is drawn these jars are covered by means of glass plates. They claim that a much better separation of bovine serum is obtained by the use of this type of jar than with all cylindrical ones of a smaller diameter. After the separation of the serum from the solid parts of the blood, it is drawn from the jars by means of a pipette, and without filtration is sealed for delivery in brown glass bottles of 10 cubic centimeters capacity. It is said that abcess formatiom seldom follows the injection of this unfiltered serum.

They think that the strength of the individual has much to do with the efficiency of the serum produced, and on this account they use only strong robust bulls as serum animals. Those which give a medium reaction to the inoculation of virulent blood are considered better for the production of serum than those which experienced a very strong or very weak reaction, as those giving a very strong reaction are believed to be weak individuals. Before a serum animal is put into constant use as such his serum is tested on a calf and must protect the calf in doses of 110 cubic centimeters per 100 kilos against the simultaneous inoculation of virulent blood.

VETERINARY INSTRUCTION.

Besides maintaining quarantine stations and slaughter-houses and laboratories for the preparation of sera and vaccines, the Japanese Government has gone still further and has established a veterinary course to prepare men for recommending and carrying out the sanitary principles for the preservation of live stock. The course is given in the Imperial University at Tokyo, and for entrance the completion of a course in one of the "higher schools" is required. The period of instruction covers three years of ten months each, and includes the principal subjects pertaining to veterinary and sanitary science.

The main building used by this course is occupied by class rooms, laboratories, and museums. The museums are especially well equipped, containing numerous specimens and models. The anatomical section contains skeletons of all domestic animals, models of the organs of special sense and viscera, and paper models of the head and limbs, showing the relative positions of muscles, nerves, bursae ligaments, and blood vessels. These models have been prepared by the professor of anatomy by means of plaster of Paris casts of dissected specimens, and are as natural and accurate as models could be made. In relation to horse-shoeing, there are specimens and drawings illustrating the positions occupied by the bones in various attitudes of the horse. Horse-shoes from various parts of the world are exhibited as well as shoes for correcting all abnormalities. Another section contains animal foodstuffs, both foreign and Japanese, and specimens of nearly all the medicinal plants. Models of horse stables and dairy barns, as well as models of the different breeds of stock are used for instruction in animal industry. Besides the models and specimens already mentioned, the museum contains a large supply of pathological specimens which have been collected by the faculty.

At the rear of the main structure are three buildings used for hospital purposes. One of these provides stable room for about twenty large animals. Another is used as a small animal house, and contains accommodations for about forty cats or dogs. Both of these buildings contain consultation and operating rooms, and are fully equipped with instruments and apparatus for clinical work. Horses are shod and clipped at the hospital, the owners being required to pay a small sum for the expense incurred.

As a whole the veterinary course seems to be very thorough and up-to-date in every way, and compares very favourably with the courses given at the veterinary colleges in the United States.

CONCLUSION.

The Japanese have shown a clear understanding of the importance of animal diseases by the establishment of suitable quarantine stations and abattoirs, and of excellent veterinary colleges and laboratories for the study of subjects pertaining to veterinary work and the education of men to protect their live-stock interest. The enactment of wise legislative measures again demonstrates their realization of the importance of live-stock protection as well as a confidence in the men who are making a life study of this work.

This realization of the importance of the live-stock industry and the confidence placed in the men capable of its protection, together with the determination of the veterinarians to put into actual practice all sound theories pertaining to the work, have in recent years prevented animal diseases from causing serious losses. There are many points in the laws, methods, and institutions pertaining to veterinary work in Japan that are worthy the consideration of other countries.

ITALY.

THE CRISIS IN THE MEAT SUPPLY AND THE RECENT ITALIAN ZOOTECHNIC PROVISIONS.

With regard to the above matter we reproduce the following from the last number of the Bulletin of the Bureau of Social and Economic Intelligence, published (31st May, 1911) by the International Institute of Agriculture.

The crisis in meat has spared no country in recent years, and consequently not even Italy. Much has been written upon its causes, which certainly are complex, but the chief cause, it appears, is the increase in the consumption of meat, which is due to the increased well-being of the lower classes.

In fact, it appears that, while in 1903 the annual average consumption of meat per inhabitant was 21 kg., in 1908 it rose to 25 kg., to arrive at 30 kg., in 1910. At the same time the employment of animals in agricultural work has also increased. It is then no wonder that, as meat is an article the quantity of which it is not easy to increase, an increase in supply has not been able to keep pace with this rapid increase in demand.

To meet the difficulty, recourse has been had to importation which, in only three years, has increased tenfold, in the case of cattle alone rising from 12,000 head in 1907 to 122,000 in 1910. At the same time exportation has diminished.

All this has given a new impulse to the rearing of Italian cattle, which has also derived advantage from the young cattle imported from abroad,

The census of cattle, in 1908, in fact, showed an increase on the figures of 1881, of 1,427,000 head of horned cattle, 1,344.011 swine, 2,567,000 sheep and 608,000 goats.

Yet neither the increased importation, nor the natural increase of native cattle, nor the diminished export, sufficed to prevent an alarming rise in price both of live cattle and of butchers' meat, whence the King's Government has thought well to accelerate the natural increase, encouraging additional zootechnic production by means of suitable rewards and various legal provisions. This is the intention of the Bill presented to the Italian Parliament on the 14th December, 1910, by the Minister Raineri, providing for the protection and increase of the national zootechnic production.

By this bill the provisions on the Estimates for Agriculture would be increased by 200,000 francs for the encouragement of horse breeding. The Minister of Agriculture, besides, will promote and subsidise the establishment of service stations *for cattle*, and the introduction of *breeding cattle* of improved stock; will grant prizes to the breeders; will encourage the development of mutual cattle insurance societies, and the co-operative dairies; will found and subvention new zootechnic institutes; will arrange for shows with prizes for breeding stock and competitions in the scientific feeding of cattle.

(Summarised from the *Bulletin of the Bureau of Social and Economic Intelligence of the I. I. of A.* Year II., No.5, 31st May, 1911.)

This article and others in this issue are taken from the new publication "Communications to the Press" issued by the International Institute of Agriculture in Rome. A summary of the contents of the Bulletin of Social and Economic Intelligence, from which these are mostly abstracted, is given below.

SUMMARY of the 5th No. (Year II) of the *Bulletin of Social and Economic Intelligence*, of 31st May, 1911 (pp. VIII and 265).

I. CO-OPERATION AND ASSOCIATION.—1. *Germany*: The Development of Co-operative Dairies; Statistics of same for the last Decade.—2. *Austria*. Agricultural Co-operative Societies registered on the 1st January, 1911.—3. *Belgium*. (*a*) The Co-operative Dairies at the National Dairy Congress; (*b*) The House Keepers' Clubs, (*c*) Miscellaneous Information.—4. *Denmark*. The new Bill on Co-operative Societies (Introduction and text).—5. *France*. Statistics of Agricultural Co-operative Societies for Production that have received Long Credits from the State.—6. *Hungary*. The 9th National Farmers' Congress and the matters discussed at it.—7. *Italy*. Current News.—8. *Russia*. The Co-operative Dairies of

European Russia and of Siberia.—9. *Bibliography of Co-operation* (classified according to Nations).

II. INSURANCE.—1. *Germany.* Insurance of Butchers' Beasts.—*Hungary.* (*a*) Bill on the Agricultural Workmen's Aid Bank; (*b*) Communal Cattle Insurance Societies.—*Italy*, Current News.

III. NON CO-OPERATIVE AGRICULTURAL CREDIT.—1. *Great Britain and Ireland.* Facilitations of Credit for the Improvement or Reclaiming of Lands.—2. *Italy.* Proposal for Reforming the Organisation of Agricultural Credit in Sardinia.—3. *Portugal.* The New Legislation on Agricultural Credit.—4. *Bibliography for the Subject of Credit.*

IV. GENERAL AGRICULTURAL ECONOMICS.—*Germany.* The Rise in price of Meat, its Causes and Remedies according to a Recent Enquiry.—2. *Italy.* New Provisions for the Increase of the Zootechnic Industry.

APICULTURE.

THE BLOSSOMING OF THE EUCALYPTUS AND ITS INFLUENCE ON THE PRODUCT OF THE HONEY-BEE FROM A COMMERCIAL STANDPOINT.

(From the *Queensland Agricultural Journal*, Vol. XXVI., Pt. 3, March, 1911.)

We had, not long ago, to remark upon the singular reticence of most of those engaged in farming pursuits, and in what may be called the minor rural industries. Amongst these are poultry-breeders, bee-keepers, nursery-men, pig-breeders, flower-gardeners, foresters, naturalists, and many others. They may make discoveries in their particular branch of industry which might be beneficial to many engaged in the same line of business, but not a word do they publish, and it is hard to get any information even by paying a visit to their holdings. It would seem as if they want to keep everything dark for fear that someone else might derive any benefit by any publicity. A few years ago we visited many parts of the State in the interests of the farming and fruit-growing community. We took photographs of the most interesting crops, machinery, stock, &c., and described the farms and the districts visited in this journal. Amongst the very interesting places visited were portions of the Blackall Range, including Nambour, Eumundi, Mapleton, Petrie's Creek, &c. From Rockhampton to Barcaldine, Cunnamulla, Thargomindah; from Cairns to Redlynch, and thence to Kuranda, Mareeba, Atherton, the Russell River, &c., we scoured the country for information subsequently published in the interests of the districts visited. What do we hear now of the life of the settlers, of their successes or failures? Practically nothing beyond a few meagre notes sent by a newspaper correspondent to some of the city and town journals, conveying the information that rain is wanted or not wanted, so that so many points fell, or that the Shire Council decided to put a culvert over a gully. As to any detailed information about crops, none is usually forthcoming except from sugar-planters. What leads us to this bit of sarcasm is that we have been asked a question about the effect of the eucalyptus on the product of the honey-bee, but bee-keepers give us no information on anything connected with bees beyond a few items in the *Queenslander* once a week.

We can find no better answer to the question mentioned than the following extracts from a paper read at a meeting of the Royal Geographical Society in 1895 by Mr. D. R. McConnel, M.A. :—

"Bee-keepers, like all others who are engaged in rural production, should be, and to a great extent must be, observers of the out-of-doors manifestations of Nature. To them the indications of a honey-flow are all the more important because the blossoms, which yield their harvest are for the most part beyond their cultivation or control. In no part of the world has it been found profitable to combine the harvesting of honey with the growing of plants to yield the nectar. The apiarist, therefore, is thrown for his returns in some measure upon the crops of neighbouring farmers, but to a far larger extent upon the wild blossoming of field and forest. His eye is on the weeds of the byways and the meadows, or scans the tree tops of the woods. To him the burden of the clouds is as momentous as to the agriculturist. A heavy sudden storm may wash out tons of nectar from the flower-cups, long-continued wet may imprison and starve his bees, and drought may wither up the sources of his spoils. It is, therefore, no idle curiosity which leads a bee-keeper to narrowly observe, and, if possible, make guiding deductions from, variations of the weather and of the efflorescence of honey-yielding plants.

"Perhaps in no part of the world is the native flora characterised by so general and abundant a secretion of honey as in Australia, and at the same time by such capricious appearance of its blossom. The former feature is remarkable, because the honey-gathering insects are comparatively few, and

the native *apidæ* are for the most part too insignificant in size to fulfil the function of floral fertilization. Probably in the case of flowering trees their fertilisation is partly secured by the crowds of honey-sucking parrots and other birds which scream and chatter among the laden boughs, and completed by the honey-eating beetles, of which there are great numbers. The uncertainty of the times of blossoming, on the other hand, is a feature more remarkable than the first, and extremely disconcerting to the apiarist. In countries of more temperate climate, furnished with a constant water supply or with more regular periods of rainfall, the honey season, if not the quantity of honey, can be depended upon with tolerable exactness. In Europe the field crops, the fruit and forest trees, the heather, have little variation in their times of blossom. In Northern America bee-keepers can count upon clover, basswood forests, or mountain sage almost to a day; and the *fall* brings in its regular supplement of goldenrod and other meadow and marsh plants. In Cuba and tropical South America the honey-flow is always in the winter months. In Northern Asia and in Canada the yield is governed by the annual melting of the snow. In India it appears the migratory *Apis dorsata* is sufficiently regular in its habits for its native owners to date by. But in Australia, at any rate in Southern Queensland, it is almost an abnormality for eucalypts to blossom in successive years, or within weeks or even months of the preceding time of flowering; while they will occasionally, though rarely, blossom twice in the same year, *i.e.*, during the twelve months from winter to winter. Comparing season with season, it seems that most eucalyptus would blossom normally every other year; but, through an age-long experience of our variable climate, they have developed an excessive, one might almost say prescient, sensitiveness to meteorological conditions. They are guilty of no temerarious lavishness in their arrangements for continuing their species. In wet seasons they will scarcely blossom at all, even for two or three years. In dry seasons they will blossom year after year until the next wet period. Indeed, it may be said that the hotter and drier the season the more abundantly they flower. But the very shoots of these trees seem to wait until the last moment to decide whether they shall become tufts of new leaves or branches of honey-laden blossom; and if by any chance they have been deceived by appearances of drought into the formation of the latter, they possess the power—even after the flower-buds are apparently fully formed—of holding them month after month unopened. I have seen a grey gum (*Eu. saligna*) in my stable-yard with flower-buds that hung for thirteen months without any apparent external change until they finally burst into blossom at the end of that long time of waiting. This was during the flood year of 1893. Incredible as it may be thought, I believe that observations of gum-tree blossoming, continued through a number of years, would give data upon which fairly reliable forecasts of coming seasons could be made. For example, the last two years, reckoned from May to May, have been an unusual period of intermittent rainfall. During that time the eucalypts have occupied themselves in extending their leaf growth; but as early as April this year almost every kind of eucalypt might have been observed to be developing extraordinary masses of flower-buds, and if the season should prove dry throughout, though not an unmixed blessing to the community in general, it will bring a wealth of harvest to the hives. Old ways are still heard of by which the weatherwise could read the skies; and old-fashioned bee-keepers believed their bees knew how to forecast the coming season. There may, indeed, be more in the affinities of Nature than we think; and we may, perhaps, come to understand better her infinite mysterious sympathies when we have ceased to attack her with the egotistic mathematicism of our day, and have learned to approach her through avenues of greater receptiveness and love.

"Besides the irregularity due to wet or dry seasons, eucalypts vary exceedingly in the normal time of flowering according to the individual kinds. *Eu. maculata* (spotted gum) flowers usually in midwinter; *tereticornis* (blue gum) about August; *crebra* (red ironbark) about September; *melano-pholia* (silver-leaved ironbark) easly in December; *sidero-phloia* (grey ironbark) sometimes in December, oftener later; *corymbosa* (bloodwood), usually the latest about March; and so on through the numerous kinds of the species. But the blossoming of individuals fluctuates much according to their distance from the coast, or position north and south. Perhaps of all the sorts in Southern Queensland, *tereticornis* (blue gum) and *corymbosa* (bloodwood) are the most constant as to the flowering time of year. It is evident then that were it

not for their irregularity in blossoming eucalypts would provide an almost unequalled succession of honey-flow throughout the year. However, the varieties do not grow so near as to provide this continuity in one locality, although so many are the different kinds that hardly any wooded district could be without something approaching it. The yield of honey from most varieties is enormous. A glorious thing it is to stand beneath a towering gum-tree almost snow-white with its profusion of blossom, its vast top 'the summer home of murmuring wings.' At such times a bee-master is as glad and as busy as his bees. The quantity of nectar compensates our bee-keepers to some extent for the irregularity of blossoming. But it is not safe for them to depend upon eucalypts alone; and there are other trees and shrubs which give an equally good and, in some cases, a better quality of honey. They belong for the most part, like the eucalypts, to the myrtaceous order. And I cannot help regretting that in a late enumeration of the products of this order, made, as published, by a distinguished botanist of this city, mention was omitted of a product so valuable and distinctive as its yield of honey.

"Among the most numerous of the *Myrtaceæ* are the 'tea-trees, all of which are rich in honey—the finest quality being obtained from those that beautify the river beds and watercourses, the red bottle-brush or river myrtle (*Callistemon lanceolatus*), and others. The paper-barked tea-trees (*Melaleuca leucadendron et* var,) and other swamp varieties have abundance of honey, but of a rank, objectionable flavour and smell, and dark in colour. All the *Angophoræ* (apple-trees and sugar gums) are good honey yielders—the so-called 'sugary gum' (*Angophora lanceolata*) having a peculiarly luscious, thick, though dark honey. The *Tristaniæ* are also most valuable honey producers, especially the 'swamp mahogany' (*Tristania suavolens*), which has a delicate honey of delicious peachy flavour and aroma, perhaps the finest to be found in the colony. The plants mentioned all flower annually, mostly in the spring and early summer, and prefer moisture to drought, with the exception of the *Angophoræ*, which share the irregularity of the eucalypts to which they are most nearly allied. There are, besides, great numbers of flowering shrubs and trees in scrubs, which also blossom annually, and yield honey of very fine flavours and colours. So reliable are scrub flowers for a yearly yield that no bee-keeper is wise to select a locality for his apiary where his bees cannot easily reach them. The marshes and swamps on the coast are covered with honey-plants, including a number of varieties of tea-trees and grass-trees, and the mangrove. But the honey gathered from such localities near the sea is very strong, salty, and dark, and I am particular in mentioning these facts, because eucalyptus honey is often credited with flavours derived from inferior sources. The results of a harvest, and the market value of a season's take, will be much modified by the presence of honeys other than from eucalypts.

"Among the eucalypts themselves the quality and quantity vary very much with the tree. The product of the blue gum (*tereticornis*) has a delightful musky perfume, very distinguishable among the hives on a warm spring evening, and a pale amber colour; but as it blossoms in late winter or early spring, the bees can seldom take full advantage of it for storing. In my experience the brightest and finest eucalyptus honey of Southern Queensland comes from the ironbarks, particularly the grey ironbark (*siderophloia*), and the broad-leaved or silver-leaved ironbark (*melano-phloia*), which is a stunted, crooked tree, and therefore seldom cut for timber. The bees seem to prefer the latter; I have seen them leave the grey ironbark almost untouched when both were in full blossom at the same time. The honey of the black-butt (*Eu. pilularis*) has the most unusual characteristic of not candying, even if kept for several years, probably on account of its extreme density, which gives it a jelly-like consistence and makes it difficult to be extracted from the combs.

"In none of the honeys of the eucalypts, so far as I have tested them, is there the slightest suggestion of the flavour of the oil secreted by the leaves. It is unlikely that in any of the species the oil is secreted with the honey, so that the reputed excellence of this kind of honey for medicinal purposes is probably no greater than that of any other honey, and rests on no other basis than the general emollient and nourishing properties of the article from whatever source. The much-talked-of and much deprecated 'eucalyptus flavour' seems to have originated in one of those commercial tricks which do so much damage to the interests of honest traders and producers. It will be remembered that a certain *savant* of a chemist, travelling in Tasmania some years ago, brought before the French public the 'extraordinary virtues' of

the eucalyptus honey he had found in that island, dark in colour, and gathered, as he stated, by black bees about half the size of the European insect. The story went the round of the newspapers, and it appears that some persons in Sydney pricked their long ears at the prospective profits of the new trade, and purchasing a quantity of so-called 'black' honey, gathered sometimes on the Clarence River in large quantities by natives and shipped to Sydney in casks, poured eucalyptus oil into it until they thought it had enough of the smell and flavour of that extract and sent it off to London. About that time there appeared in the *British Bee Journal* some paragraphs on the horrible 'eucalyptus' smell of the new Australian honey, which threatened to stink visitors out of the Agricultural Show where it was exhibited. The *British Bee Journal* is, or was at that time, 1891, edited by Mr. Thos. W. Cowan, F.L.S., F.G.S., &c., &c., a distinguished scientist who had made a hobby of microscopes and bees, a member of the famous family of paper manufacturers in Edinburgh. An uncle of mine, also with a hobby for bees, was a personal friend of Mr. Cowan's, and had written to him on the prospects of a market for his Australian nephew's honey. Mr. Cowan's reply is in my possession, in which he assures my uncle that 'if his nephew's honey is no better than the Australian honey he had seen and tasted, he (the nephew) would have a difficulty in disposing of it.' Mr. Cowan mentioned at the same time that Australian honey fetched from 25s. to 30s. the cwt., and was bought by druggists. (It was then the time of the great influenza epedemic.")

SCIENTIFIC AGRICULTURE.

THE CENTRALIZATION OF AGRICULTURAL RESEARCH.

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLVI., No. 17, April 29, 1911.)

Agriculture, in the modern sense of the term, is a many-sided subject, and requires for its successful advancement the work of many men who have been trained, not only in different branches of natural science, but also along very different lines. The two extreme types of men interested in the advancement of this most important branch of human knowledge are represented by the practical planter on the one hand, and the academical scientist on the other. Midway between these stands the man entrusted with the care of field experiments, who must be possessed not only of a general knowledge of the nature and value of the different branches of scientific investigation, but also of the methods and conditions of practical agriculture as exhibited in the district to which his work is intended to be of service.

Now it is part of the nature of scientific research that the general conclusions at which it arrives are, in many cases applicable to practical methods over a very large area, when once they have been modified to suit local conditions. Consequently, the number of individuals required to investigate the scientific side of any problem is relatively small, while the number of practical workers to whom they may be of value is large. The channel by means of which the results obtained in the laboratory are usually conveyed to the practical workers in any agricultural district is through the man entrusted with the conduct of field experiments. The number of these men must depend either on geographical conditions or on the extent to which land is under cultivation. The functions of the middle man referred to above are three-fold. In the first place, he must test the value of laboratory results as applied to the production of crops under local conditions, though the lines along which these tests should be made must be indicated by the scientific investigator who interprets the results. In the second place, he is required to give advice when needed to the practical worker, in the light of the knowledge acquired from the tests conducted, so that the information obtained may be thoroughly disseminated. Lastly, he may from his experience of local problems suggest lines of investigation, which would be of value, to be conducted by the appropriate members of the laboratory staff.

The body of academical scientists is generally composed of men who have been trained in one of four special aspects of natural science. They may be concerned with the determination of the composition and properties of substances employed in agriculture (Agricultural Chemistry); with the study of plants of economic importance (Botany);

with the investigation of the damage inflicted on crops by animals, particularly insects (Entomology); or in studying the ways to prevent the loss due to the lower forms of plant life (Mycology). The problems which they investigate are suggested in the course of their work, by a study of the current literature of their subject, or by consideration of the suggestions received from those in charge of field experiments in a large number of different districts. In the case of the Entomologists and Mycologists, scientific investigations may also be necessitated by the occurrence of an epidemic attack of some insect pest or fungoid disease. It should, however, be understood that it is not necessary for such workers to possess, as part of their equipment, a detailed knowledge of the conditions of agricultural practice in any special district; what they need is to be accurately informed of those conditions, in the places where their advice is required, in order that they may be enabled to recommend the adoption of the measures that are most suited to those conditions. It is here that those who are in charge of experiment stations possess a particular usefulness in giving the specialist an accurate idea of the circumstances in which his knowledge may be applied. This knowledge is general. It only requires to be adapted in such a way as to apply to the problem which is causing uneasiness to those who are engaged in agricultural pursuits for the purpose of making a living.

It is part of the function of the laboratory staff to keep itself thoroughly in touch with all the current literature relating to the subject of scientific agriculture, as well as to conduct research. This literature must be correlated and disseminated, through the medium of definite publications, in a form in which it is of most service to the practical man. Besides rendering available all the latest results of investigations made in other parts of the world, the body of scientific investigators must prepare more technical articles setting forth for the benefit of other similar bodies the results of its own researches.

The value of co-operative effect between the various types of men concerned with agricultural interests is well illustrated by the working of such departments as those in India and the United States. Institutions of this nature are, broadly speaking, modelled on the lines already indicated. The scientific staff is subdivided into groups of men concerned with the investigation of problems connected with one branch of science only. Their results are conveyed through middle men and thus become available to the farmer. It is clear that when such a department requires to enlarge the sphere of its activities to include a new area, it can do so to the best advantage, not by increasing the personal of its scientific staff, but by adding to the members of the middle men in its employ. A body of specialists whose work is intended to elucidate problems connected with agriculture in India has recently been assembled at the Agricultural Research Institute at Pusa. The results obtained by them are published, and so made available to the various provincial departments and planters' associations, and the scientific officers of these institutions direct the application of the results to the conditions of cultivation which exist in their districts. All such organizations are intended to direct and economize the energy spent on scientific investigation, in order that the most satisfactory results may be obtained for the minimum expenditure of labour, money and time.

THE VALUE OF HUMUS.

(From the *Agricultural News*, Vol. X., No 232, March, 1911.)

In those islands of the West Indies where sugar-cane cultivation is carried on more particularly, the agricultural procedure, which is often the outcome of the experience of several generations of planters, shows that the importance of an adequate supply of humus in the soil is generally recognized. Every effort is made to keep the soil in good condition by the use of farmyard manure, and as little waste as possible is permitted of such plant remains as are available for application to the field; while there is a constantly greater understanding of the need and importance of green dressings.

It is generally understood, by now, that the term humus means to the agriculturist the dark-coloured material, formed of plant remains, that gives the soil its characteristic different colour from that of the sub-soil. The researches of recent years have shown that this material is formed, from vegetable waste, by the action of bacteria in a partial or total absence of air. The circumstances under which it is produced cause more of it to be found in land that has not been tilled for some time than in that which has been turned over regularly; this condition is met with more frequently in temperate climates than in the tropics. It is a

matter of common observation, however, in this part of the world, that the humus content of clay soils is higher than that of sandy soils, because the access of air to the interior of the soil is not as great in the case of the former as in the latter; so that almost ideal conditions for the production of humus are afforded by clay soils.

In dealing with humus more generally, it will be well to treat in turn, of its importance, firstly in relation to the soil, and secondly with reference to the plant. It must not be forgotten, however, that all final effects of humus have a direct or indirect influence on the plant; for whatever affects the soil must ultimately have its influence on the vegetation which it supports. One of the most useful effects, to the agriculturist, of the possession by a soil of a good humus content is the circumstance that this improves its texture, so that there is ease as well as economy in tillage operations. The artificial employment of this fact has its largest application on heavy clay soils, in the improvement of their condition by the use of vegetable matter either in the form of decayed remains such as trash, or as withered green dressings. Another matter, to which a passing reference only need be made here, on account of its comparative unimportance in the tropics, is the effect of humus in darkening the colour of soils and thus increasing their ability to absorb heat.

It is recognized by the agriculturist that all soils contain mineral plant food in an unavailable condition. He, knows, too, that some of this may be freed in a state in which it can be used by plants, by the employment of artificial dressings such as lime. Humus probably plays the greatest part, however, in this matter, both artificially and in nature. This is because of its power to form bodies, commonly called humic acids, which have a dissolving action on some of the mineral constituents of the soil. The process is naturally slow but is continuous, and where the soil is well supplied with humus, its eventual importance in relation to the provision of mineral plant food is obvious, especially when consideration is given to the comparatively small bulk of this food that is necessary to plants.

A final general matter in connexion with humus in a soil is probably of the greatest concern as regards its ultimate effect in enabling that soil to produce quantities of vegetation. This is the circumstance that it provides ideal surroundings to, and a certain amount of food for, the bacteria which effect improvements in the soil, from the agriculturist's point of view. This appears particularly to be the case in relation to the nitrogen-fixing organisms. Greater recognition of the importance of the extent to which these affect the nitrogen content of the soil is being attained rapidly, and the matter is brought particularly to the notice of agriculturists on account of the comparative difficulty and expense of sustaining an adequate nitrogen content in the land from which they raise their crops.

The next matter to consider is the value of humus in relation to the plant more directly. In the first place, humus itself contains nitrogen, potash and phosphates, and this is a fact that becomes of importance when the suggestion is made to remove plant waste from the land, or on the other hand, to bring in supplies of vegetable material from other areas on which it has been raised. The matter will be considered further, in the former aspect, when the question is raised of the destruction of vegetable matter for the control of pests.

The most important and most fully recognized direct function of humus in relation to the plant is the effect that it possesses in increasing the capacity of soils to absorb water, as well as their ability to hold it when it is supplied to them. It has been considered already that the power of a plant to grow depends upon the existence of several limiting factors, the absence of, or deficiency in, any one of which will interfere with its power development. Of these factors, as is well known, the one whose absence or insufficiency most quickly shows itself is the water-supply, and the importance of humus in keeping this at an adequate level cannot be under-estimated.

The consideration may now be undertaken of some of the more particularized facts in relation to humus. One that has been indicated already is the quick rate at which vegetable matter is lost from sandy soils. This is on account of the easy access of air to such soils, whereby the bacterial action which would lead to the formation of humus is prevented, and oxidation takes place; so that the material is quickly lost in the atmosphere. It is in such soils that the agriculturist requires to exercise the greatest care in regard to the supply of humus, especially as if this is deficient, any water that they receive passes away almost immediately through drainage.

The burning of waste vegetable matter, particularly of trash in cane fields, for the eradication of pests, is often

recommended. It appears; however, that this can only be done continuously, with impunity, where there is irrigation and the plentiful supply of artificial manures, as in Hawaii; and it remains to be seen, even there what will be the ultimate effects of the procedure.

Other matters that remain for short consideration in the present relation are those dealing with what is called 'soluble humus,' and the connection between carbohydrates in the soil and the increase of efficiency of the nitrogen-fixing organisms. Soluble humus, it may be explained, is the product obtained by the action of alkalis such as ammonia and soda on the humic acids; there is a large amount of this matter dissolved in the dark liquid that drains away from manure heaps, because of the alkalinity of the contents of such heaps through the production of ammonia. Much remains to be discovered concerning soluble humus, and it is not yet known with certainty if similar bodies are of direct use to green plants.

The effect of the presence of carbohydrates in the soil, in increasing the power of the nitrogen-fixing bacteria to do the work that is required of them, is probably due to the greater provision of food, whereby there is an augmentation of the number of bacteria present above that which is normal, with a consequent enlargement of the amount of nitrogen fixed. Information concerning the question has been given already; it is receiving some attention in a practical way, more particularly in Antigua and Mauritius where experiments on a field scale are being undertaken. Little consideration will show that work of this and a similar nature should throw much further light on the matter of the value and importance of humus to the agriculturist.

AGRICULTURAL FINANCE AND CO-OPERATION.

LAND IMPROVEMENT CREDIT IN GREAT BRITAIN FROM 1846 TO 1910.

State credit on behalf of agriculture is provided for in England by numerous laws, amongst which we may mention those of 1846, 1849, 1864 and 1899. The administration of these laws (the most important of which are the Public Money Drainage Acts, 1846 to 1856, the Private Money Drainage Act, 1849, and the Improvement of Land Acts, 1864 and 1899) has been entrusted to the Board of Agriculture, who periodically render an account of their working.

From a recent publication of the Board, the *Bulletin of Economic and Social Intelligence* of May 31st, 1911, published by the International Institute of Agriculture, takes some data of which, from their interest, we think well to give a summry :—

It appears that in the period of 63 years from 1847 to 1910 more than 18 millions sterling was advanced for land improvement in Great Britain. Only part of this sum (about £4,000,000) was advanced out of public money; the remainder was private money, advanced to landowners under the provisions of special laws.

The greater part of the money advanced—about nine millions, out of a total of 18 millions—was devoted to drainage. The amount advanced for the erection of farm buildings was also considerable, viz., about 5½ millions in 63 years. Then follow the advances for the building of labourers' cottages (nearly 1½ millions); for the erection of mansion houses (nearly one million); for fencing and embanking (close upon half a million), and for roads (nearly a quarter of a million). Other smaller sums were advanced for minor improvements.

This not inconsiderable sum has been advanced in different proportions in the various years; more largely at the beginning and to a less extent later. It appears, in fact, that while the average amount advanced per annum between 1846 and 1882 was £387,000, it was only £158,000 per annum between 1883 and 1910.

This diminution was due, not only to the fact that the most important improvements necessary were soon made, but to the crisis which occurred in English agriculture in the last decades of the 19th century, and made the landowners chary of placing burdens upon the land, the return from which, it seemed, must continue to diminish.

In regard to the procedure which a landowner must follow in order to obtain an advance, full information is given in the article quoted, and we refer the reader who is desirous of further prrticulars to the *Bulletin* itself.

(Summarised from the *Bulletin of the Bureau of Economic and Social Intelligence of the International Institute of Agriculture*, 2nd Year, No. 4, May 31st, 1911).

SOAP COMPANY INCORPORATED.

CAPITAL P100,000—WILL COMPETE WITH IMPORTED SOAPS—GOODS ON MARKET JUNE 15.

(From the *Manila Bulletin,*)

The Philippine Soap Company has been incorporated with a capital of P100,000 and will enter the market to compete with imported goods.

The new company has opened offices at No. 90, Calle Arlegui, will begin operations on June 4, and will be ready to place its goods on the market by June 15.

The company has engaged the services of a Spanish expert in the manufacture of soaps, who has been trained in Spain and Italy, and thoroughly understands the business. Plain goods will be placed on the market to begin with, and later it is the intention of the company to manufacture fancy soaps. Manila and the Philippines offer a good field for the manufacture of soaps, as almost all the soaps used in the islands, with the exception of cheap Chinese soaps, are imported from foreign countries.

The officers of the new company are: President: T. J. Wolff, well-known in this city as president of the Sanitary Steam Laundry; Secretary: L. F. Goodale, the Supervising Railway Expert of the Insular Government; Treasurer: J. Williamson.

FRANCE.

LOANS OF FOUR MILLIONS MADE TO THE AGRICULTURAL CO-OPERATIVE SOCIETIES FOR PRODUCTION AND SALE IN THREE YEARS, UNDER CONDITIONS OF FAVOUR.

With regard to the above we extract the following from the last number of the *Bulletin of the Bureau of Economic and Social Intelligence*, published by the International Institute of Agriculture.

Everyone knows the magnificent progress that agricultural association has made in France during the last twenty-five years, especially by means of those agricultural syndicates that owe their origin to the Law of 1884, and that, rapidly extending themselves over the whole land, to-day have reached the number of 5,200.

These organisms, that the French are not wrong in considering as the germ cells of the associative movement, do not confine themselves to the defence of the professional interests of their members, but also do business in buying and selling for their members, and initiate every kind of mutual and co-operative societies, from the mutual credit (3,000) and insurance societies (10,700) to the co-operative societies for production and sale (2,600). To these last the interest of the legislator is especially given as he sees in them important instruments for the preservation and the advancement of peasant property.

A few of these societies, as the co-operative dairies and cheese factories (fruitières) are of very ancient origin, especially in the Alps and in the Jura, but almost all the rest are of recent date, and have arisen as the expression of the industrial evolution that agriculture is undergoing.

Many of them require, through the very nature of their business, a large plant and an expert technical staff: hence the necessity of resorting to credit, hence the intervention of the State to place at their disposal a cheap long term credit.

The law of 29th December, 1906, on long credit to the agricultural co-operative societies provides for this need. It authorizes the Regional Banks (intermediary organs between the State and the Local Societies) to grant the agricultural co-operative societies for production, transformation and sale long credits for a maximum period of 25 years at an interest not exceeding 2 %. The regional banks do not take the money necessary from their own capital, but it is advanced them without any interest, by the State, to which it is supplied (always without interest) by the Bank of France.

The agreement of the 31st October, 1896, and the law of 17th November, 1897, in fact, establish that the Bank of France must lend the State, without interest, for purposes of agricultural credit, the amount of 40 million francs to be repaid on the expiration of the privilege of the Bank, and in addition to this, an annual sum equal to the amount of an eighth of the rate of the discount multiplied by the amount of the bank bills but never less than two millions. Now, by the law of 29th December, 1906, the State is authorized to advance to the agricultural co-operative societies for production, through the medium of the Regional Banks, a third part of the above annual sum, which in a few years has even amounted to 7 millions.

The beneficent effect of this law was at once felt, for the agricultural co-oper-

ative societies for production rapidly increased in number and importance.

From a recent publication of the French Ministry of Agriculture: *Dix ans de crédit agricole*, Paris, 1911, we learn that at the end of 1911 as many as 123 co-operative societies had profited by the new credit to a total amount of 4,132,180 francs.

These sums were distributed as follows: 30 dairies with a capital of 856,810 francs received 1,334,930 francs for an average period of 12 years; 21 *fruitières* with a capital of 297,412 francs, received 460,800 francs for an average period of 15 years; 27 wine growers' societies with a capital of 676,626 francs, received a loan of 922,603 francs (for an average period of 18 years); 5 wine and oil societies with a capital of 62,050 francs, 103,250 (average period of loan 18 years); 5 oil mills with capital of 50,187 francs, 68,250 (17 years); 10 distilleries with capital of 324,355 francs, 521,965 (16 years); 16 societies for collective purchase and utilisation of agricultural machines, with 66,175 francs capital, 120,442 (10 years); 2 starch factories with 74,000 francs capital, 52,000 francs (22 years); 7 societies of various kinds with 356,570 francs capital have received loans of 547,940 francs.

Among the co-operative societies receiving larger assistance, let us mention the co-operative dairy of Periers (Manche) and the winemaking co-operative society of Toulouse, each of which received 100,000 francs, the Distillery of Ameville-sur-Scie (Seine Inférieure) and the Agricultural transport society of May-en-Multier (Seine-et-Marne) to which were accorded respectively 140,000 and 150,000 francs.

It is well to note that the largest loan the State is empowered to make, in virtue of this law, to each co-operative society must not exceed twice the fully paid up capital of the co-operative society itself.

(*Summarised from the Bulletin of the Bureau of Social and Economic Intelligence of the I. I. of A.* (Year II. N. 5, 31st May, 1911).

EDUCATION.

SCHOOL GARDENS IN JAMAICA.

BY P. W. MURRAY,
Instructor for School Gardens.

(A Lecture delivered at the Agricultural Course for School Teachers, 1911.)

(From the *Bulletin of the Department of Agriculture, Jamaica*, Vol. I., No. 4.)

Importance of a Teacher's Position.—The work of a teacher should be not merely to impart to his pupils a knowledge of letters. It should go further and give the child a broad view of the social life of the community, of his duties as a citizen of that community, and of his responsibility to prove himself a useful member of society when he leaves school and goes out to work. If such an aim were the ideal of every teacher, a boy in after life would remember his teacher with a sense of gratitude—gratitude the result of success and of the thought that his teacher has fitted him directly to obtain that success—I say, he would remember his teacher with such feelings, rather than, as so many of us do, with a sense of aversion and dislike because of unjust treatment in the past and uncalled for impositions in the classroom.

The movement of the times points to an additional and intelligent development in the curriculum of our schools. Experience has proved that there is no power of education greater than that of bringing the young mind in touch with the plant and with the soil, and in so doing, teaching him something of the marvellous work of the Great Creator.

Better than any book used for imparting knowledge is the workshop of nature, if I may so express it, and as a ready and convenient miniature of this mighty workshop the school garden has been brought into operation.

Jamaica an Agricultural Country.—Jamaica, as we all know, is entirely an agricultural country. Our present wealth has come directly from the products of our soil. Our interest in the future so far as we are able to see, will lie in this self-same direction; hence the necessity of giving the children of our elementary schools as thorough a knowledge as possible of agriculture. Eighty per cent. (80 %) of our school children will probably earn their living by some form of agricultural work, and we should make every effort, direct every force, use every means at our disposal to fit them for their life's work. If we can

create an interest in the children's minds that will stimulate them to seek for knowledge in this direction. they will become intelligent workmen, and their labour will increase the general prosperity of the island. If we can encourage the children to look forward to homes of their own, and this healthful out-of-door work where they will derive strength from the soil, it must have the ultimate effect of producing a hardy profit.

Value of Education.—I have tried to show that it is toward agriculture that we in Jamaica should now turn our attention. Now there is often seen in our people a tendency to avoid the soil. School gardens will. if properly used, correct this tendency, and at the same time give better ideas of agricultural work than those which we have at present.

It is an old adage that "we must bend the tree while it is young." It is therefore important that we should mould our children's lives as far as possible in the most approved ways along those lines which they will most probably have to follow.

Functions of School Gardens.—The general functions of the School Garden may be classified as follows:—

1st, and this I consider the most important. To bring the child in touch with nature, and to enable him to appreciate something of its wonder. It will ever be the source of its greatest pleasure and inspiration if he is taught to see behind the flower the hand which paints it.

The efforts to draw out such observation and to strengthen it by daily uses in the many directions which a school garden supplies, cannot fail to tell very powerfully on the general mental and moral nature of the child and in the up-bringing of a good and a useful character.

2nd. To develop the power of observation.

Indifference to our general surroundings, due to lack of observation, is the fatal cause of narrow knowledge and consequently limited development. Nature broadens out and blesses the mind which recognises the many things which she presents for consideration, and the many lessons which she teaches for practical conduct.

3rd. To develop accuracy. The necessary work connected with a school garden, such as the laying out of beds and the correct manipulation of the tape line cannot be too highly estimated as a valuable addition to a child's education. The ability to lay off a straight line, and work to that line is, as most employers of adult labour know, a power that is largely absent from our working population, especially in the country districts. This glaring defect will be most certainly corrected in such training as a child will receive in connection with a properly conducted school garden.

4th. To train directly for life's vocation, and to correct the tendency to avoid agricultural pursuits now so evident in certain portions of the island.

In all countries where enforced labour in any direction existed for a long period, as soil cultivation did here for the many years of slavery, the emancipated people and their descendants have generally manifested an aversion to that description of labour. I venture to express the opinion that no means of curing this fault will be more effective than those which the school gardens afford. In the course of a few years, instead of the aloofness from agriculture, which we now witness in so many of our intelligent young people, leading them to reside in the cities and towns and to search for employment in directions already overcrowded, or to leave the island, we shall find an eagerness to follow a pursuit which is more fruitful than most others, one full of real pleasure, and which if patiently and perseveringly followed will not fail to yield also profit in solid cash.

School Gardens in Home Life.—The large majority of our adult population are apparently perfectly content with their untidy environments, and it is to be feared that we must look to the rising generation for any general advance in neat cottages with their well-kept kitchen gardens and flowering plants.

If the children are trained intelligently, and their love for Nature excited and enthusiasm evoked in the school gardens, it will be well nigh impossible for them not to carry improved taste and improved habits into their homes. It is more than the expression of a hope that instead of cottages in the midst of bush or with economic plants struck anywhere and anyhow, we shall in time see homesteads marked by evidence of industry, order, care and comfort.

In some of the schools which I have visited, I have, on speaking to the children, suggested to them that efforts should be put forth in this direction. Some of the teachers have agreed to visit the small gardens kept by the children at their homes and award a prize in the form of a book to the child

who has the best garden, the Inspector of Schools presenting the prize on the day of the inspection of the school. These small gardens as an outcome of school garden work are in my opinion the best test of the work of the school garden. Where a child has been so thoroughly interested by the teacher in his work as to imitate that work in leisure hours at his home, it is evident that that teacher understands his work, and is himself interested in it.

School Gardens afford Practical Object Lessons for Class-room Work.—The school garden should, I may be pardoned for thinking, form also the basis around which the major portion of the school work should be centered. It should be used to give definiteness in instruction. It is wonderful how adaptable a garden is to the study of the three "R's." We have already in use in our schools many books on agricultural subjects from which our reading lessons are taken. I should like to draw your attention to another which has been recently introduced, the Hon. J. R. Williams' book on School Gardens. The school garden can be run in conjunction with this book, and lessons read from it, either by the teacher to the school, or by the children to the school, should immediately be put into practice, or the attention of the children drawn to the facts as stated in the book while at work in the garden.

For example, when reading about the flowering or the root system of a plant, an object lesson taken from the school garden should always be given. This would vastly improve the child's reading, and also his knowledge of the plant, and doubly increase his interest in his reading lesson.

Nothing is more distressing than to be told to write a composition upon a subject about which you know absolutely nothing, or upon a subject about which you have no interest. I am speaking from my own experience and from observation, when I say that one chief difficulty in the case of young children is the lack of something to say on the subject proposed. The teacher should find in the school gardens a well-stocked recruiting ground for composition subjects, readily understood, of varied interest, and on which the child, if he has been previously brought into contact with the work, should find no difficulty in writing at some length.

The school garden supplies material for Arithmetic of all kinds, Addition, Measurements, Fractions, Subtraction, Division, Multiplication, Areas, Accounts, etc., etc. These could all be readily and aptly illustrated from the school garden, and would give definiteness to the subject under discussion.

In order that these functions may be effectively carried out, it is necessary that the school garden be modelled along such lines as will ensure the working out of the points in view. I may say briefly that a school garden is not a miniature ground, or a kitchen garden, as so many term it. It is essentially an educational medium, and should be kept up to that standard, if ever the results which are anticipated and desired are to be attained. I have had to propose very formidable changes in the planning of our school gardens. This has not been done to give the teachers unnecessary work, but to ensure results of educational value, and in many cases such a remodelling has been followed by an increase varying from 30% to 100% in the grant awarded at the annual inspection.

Planning a Garden.—The following are some of the principal features to be considered in the planning of a garden:—Simplicity of arrangement, at the same time embracing all that is desired. Order, for without order it is impossible to attempt to teach anything, much less such a subject as we are discussing. There must also be a methodical classification of the different crops of the garden if results are to be attained. It is just here that the gardens of our country have failed. There is little or no classification at all evident. It is contrary to all fundamental principles of Agricultural practice, to grow together and upon the same bit of land at the same time, with but few exceptions, crops of different varieties.

We are so bountifully blessed in this Island with productive conditions, that it has been possible to produce two average crops in many cases, on the same bit of land growing together. This has always been followed by the absolute destruction of that land, which has resulted, unless heavily manured, in its abandonment, and the necessary amount of cleaning and replanting another such plot by the owner. This glaring fault has also destroyed the advantages, which are to be had and which should certainly be illustrated in the school gardens, that of rotation of crops, which should have resulted in an improved condition of the soil and would have obviated the necessity of removal.

Classification is also necessary to the study of the peculiarities, or of the

requirements of any one crop. It is also important to the study of the difference in variety of any one kind of economic plant. Without a proper classification, it would be impossible to conduct a garden of any value for all the benefits that are expected to result upon the mind of the child are dependent on this point.

A school garden should contain all the economic crops of its particular district. We have not yet reached the stage when it is fair to suppose that further knowledge, and advantages to be derived therefrom, is not to be discovered upon any one of our staple crops. The method of treating these crops, or rather the soils upon which they grow, or the tree which produce them are still open to considerable improvement. I might say that our people, as compared with other countries, have only just begun to realise that there is such a thing as an intelligent agricultural practice, and that the plant is a living, breathing organism, and will respond in a most sensitive manner to either good or bad treatment.

The treatment of our soil is still open to much improvement. We do not realise that it teems with life, that it has physical, chemical and biological properties, and that all of these are to a large extent within our control. I may say there is a field here and an opportunity for the teacher who realizes this, to interest his children to such an extent that they will see that there is more on the earth upon which they live than mere dirt.

Practical use of School Gardens.—The school garden should also be a means of introducing into a district any possible crop that might be of value to the district. I know of one particular garden which has been of the greatest value to thousands of people, by teaching them as object lessons how to cultivate vegetables. I speak of the Mount Fletcher school or Mavis Bank school garden, situated in the Port Royal Mountains. This garden has been the means of introducing and fostering the vegetable industry of these hills which send into the city of Kingston weekly produce to the value, I should think, of a couple of hundred pounds.

The people of these mountains were for many years dependent on the large coffee plantations for their livelihood. The majority of these plantations have gradually died out, thus reducing the quantity of work and the price of labour —poverty and hard times were the result —and were it not for the development of this valuable industry both to the people themselves and to the city of Kingston, these mountains would have been largely abandoned by the working population. This same industry has been largely extended throughout Manchester by means of the school gardens, and I see no reason why the same work should not be done on a larger scale than at present exists in other parishes. We certainly have the soil and climate. All that remains is a knowledge of the industry, and the men to push it.

Experimental Work in School Gardens. —A school garden should also afford, or be the means of testing different varieties of the same plant, so that it may be known which variety is best suited to each particular district. We have not yet learnt even in our staple crops that it is possible to improve to a considerable degree the plants which we cultivate. Even the sugar-cane to which I can testify, is open to much improvement. It has been found that in many cases an increase of yield of from 30 % to 15% has resulted by introducing a new variety of cane produced by the crossing of our local variety on imported stock.

It is also a known fact that in every district we find several varieties of the same plant in our grounds. Take for instance the cassavas. There must be, I should think, at least ten varieties commonly grown. The school garden should test these in small lots to find which is the quickest-maturing, which in a given time, say 12 months, will give the heaviest yield, and which will best withstand the drought. These are points with which few have as yet experimented outside of the Hope Gardens.

These facts would supply a much-needed knowledge and be the means of bringing better results with the minimum of labour and care.

The same thing might be done with canes and potatoes. In the banana business, everything depends upon knowing when to prune your trees so as to meet top prices. This can only be done by a careful study of the habits of the plant and by continuously experimenting with it. Each banana root should be carefully labelled, showing the date of planting, the date when the pupes and tubers were allowed to run on shooting, and the date of cutting. From these facts it will be readily seen how to handle the plant so as to meet the best market. Labels should not only be attached to this one section but to every section of the garden, showing up plainly and distinctly.

Interesting work should also be conducted in the coffee section which should be of course nicely established through-

out the bananas or plantains. It has often been held that Long Top coffee is the only method of training our coffee trees in some parishes—I doubt this. The advantages to be had in training our trees to the short top system are too great to be lightly passed over, and the school garden should be the testing field. It would be most interesting to establish both systems in the gardens and record carefully the results. Grow for instance the short top in the plantain section, and the long top in the bananas, or where the entire crop is grown in the plantain section, then divide this section.

Much useful work may also be done in showing the effect of the mulch which is so absolutely necessary in some parishes. I should advise that one-half of some of the beds be mulched and the other not. It will generally be found that this is the determining factor in the yielding capacity of most of our soils.

I had the pleasure of visiting a school garden at Top Hill on the border of the Pedro Plains in St. Elizabeth, in company with Mr. J. P. Palache. For two years the people of this district have been put to the greatest straits for want of food due to the severe droughts which have visited them, many having to tramp for long distances over bad roads even to secure the corn and breadfruit which formerly was so plentiful among them. What was my surprise then, on passing through the desert, if I may so express it, to find just on the borders a regular oasis of healthy, vigorous vegetation in which cassava, yams, corn, potatoes, &c., were all growing in profusion. This had continued all through the drought, and had been one of the main supplies, combined with 2 or 3 or 4 acres in similar condition in the district. One had to see this plot to fully realize its significance.

This condition was brought about by the combined forces which should be in strong evidence in all our gardens, viz., deep and thorough forking and the application of a heavy and continual mulch.

I shall touch upon the last feature of a garden before I close, and that the ornamental or flowering section.

Ornamental Section.—This, in my opinion, should be the ornamental section, and should therefore be kept separate and distinct. Its proper and correct place is, therefore, the border running around the lower or annual section.

I would suggest that in this section, the permanent and ornamental shrubs be planted, such as the shoeblack, the croton, &c., all being kept to a height of 3 feet. This will give colour to the garden, and at the same time in no way interfere with the major or economic section.

MISCELLANEOUS.

CEYLON AGRICULTURAL SOCIETY.

MINUTES OF ANNUAL GENERAL MEETING, JUNE 20TH, 1911.

Minutes of a General Meeting of the Ceylon Agricultural Society held at the Council Chamber at 12 noon on Tuesday the 20th June, 1911.

His Excellency the Governor presided.

The others present included:—The Hon. Sir Hugh Clifford, Hon. Messrs. Senior, C. T. Vigors, P. Arunachalam, Solomon Seneviratne, A. Kanagasabai, Sir Solomon Dias Bandaranaike, Drs. Willis and Lock, Messrs. R. W. Smith, E. B. Denham, W. D. Gibbon, Francis Beven, James Peiris, A. E. Rajapakse, Dan. Joseph, J. D. Vanderstraaten, and the Secretary (Mr. C. Drieberg). Visitor: Mr. C. B. Brodie.

The minutes of the meeting held on June 8th, 1910, were read and confirmed.

The Hon'ble Mr. Arunachalam moved and Mr. W. D. Gibbon seconded the adoption of the Report for 1910-1911.—Carried.

Commenting on the Report, His Excellency announced that negociations were proceeding with the Bombay Government for the training of Agricultural Instructors at the Poona Agricultural College, and that Government proposed to offer four Scholarships for this purpose.

Statement of Revenue and Expenditure for the year ended December 31st, 1910, having been previously circulated, was tabled.

Mr. James Peiris moved, and the Hon'ble Mr. Solomon Seneviratne seconded, the adoption of the Report of the Committee appointed to deal with the

question of bringing the villager into closer touch with the Society.—Carried.

Mr. Francis Beven moved and Sir Solomon Dias Bandaranaike seconded that the following Committee (with power to add to their number) to organise an all-Island Agri-Horticultural Show for 1911 be appointed :—The Director, Royal Botanic Gardens, the Curators of Peradeniya and Hakgala Gardens, the Government Agents of the nine Provinces, the Assistant Government Agents for several Districts, the Chairmen of the Planters' Association of Ceylon, Chamber of Commerce, and the Lowcountry Products Association, Dunuwille Disava, Secretary, Ceylon Agricultural Society, the Government Veterinary Surgeon, the Maha Mudaliyar, the Colombo Atapattu Mudaliyar, the Hon'ble Messrs. Seneviratne and Kanagasabai, Messrs. E. B. Denham, A. J. R. de Soysa, M. Kelway Bamber, J. D. Vanderstraaten, L. W. A. de Soysa, and Francis Beven, Mudaliyars A. E. Rajapakse and C. M. Sinnaiah.

The consideratien of Mr. van Leenhoff's Report on the Tobacco Experiment at Mahailuppalama was withdrawn from the agenda on the suggestion of His Excellency the President that it should be brought up at the next meeting of the Board. With reference to an enquiry from His Excellency as to how certain alterations in the report came to be made, Dr. Willis explained that they were made at a meeting of the Tobacco Committee at which Mr. van Leenhoff was present and with the latter's approval. The Hon. Mr. Senior added that some of the remarks in the original report were made under a misapprehension on the part of Mr. van Leenhoff, whose knowledge of English was not very perfect. It was therefore found necessary to somewhat modify the report in certain places, and this was done with Mr. van Leenhoff's consent and approval.

Mr. R. W. Smith, Director of Irrigation, read a paper on "Wells." The paper by Mr. A. W. Beven entitled "Notes on Coconut Cultivation" was, in the absence of the writer, taken as read.

H.E. the President moved a vote of thanks to the writers of the two papers.

C. DRIEBERG,
Secretary, C.A.S.

20th June, 1911.

WELLS.

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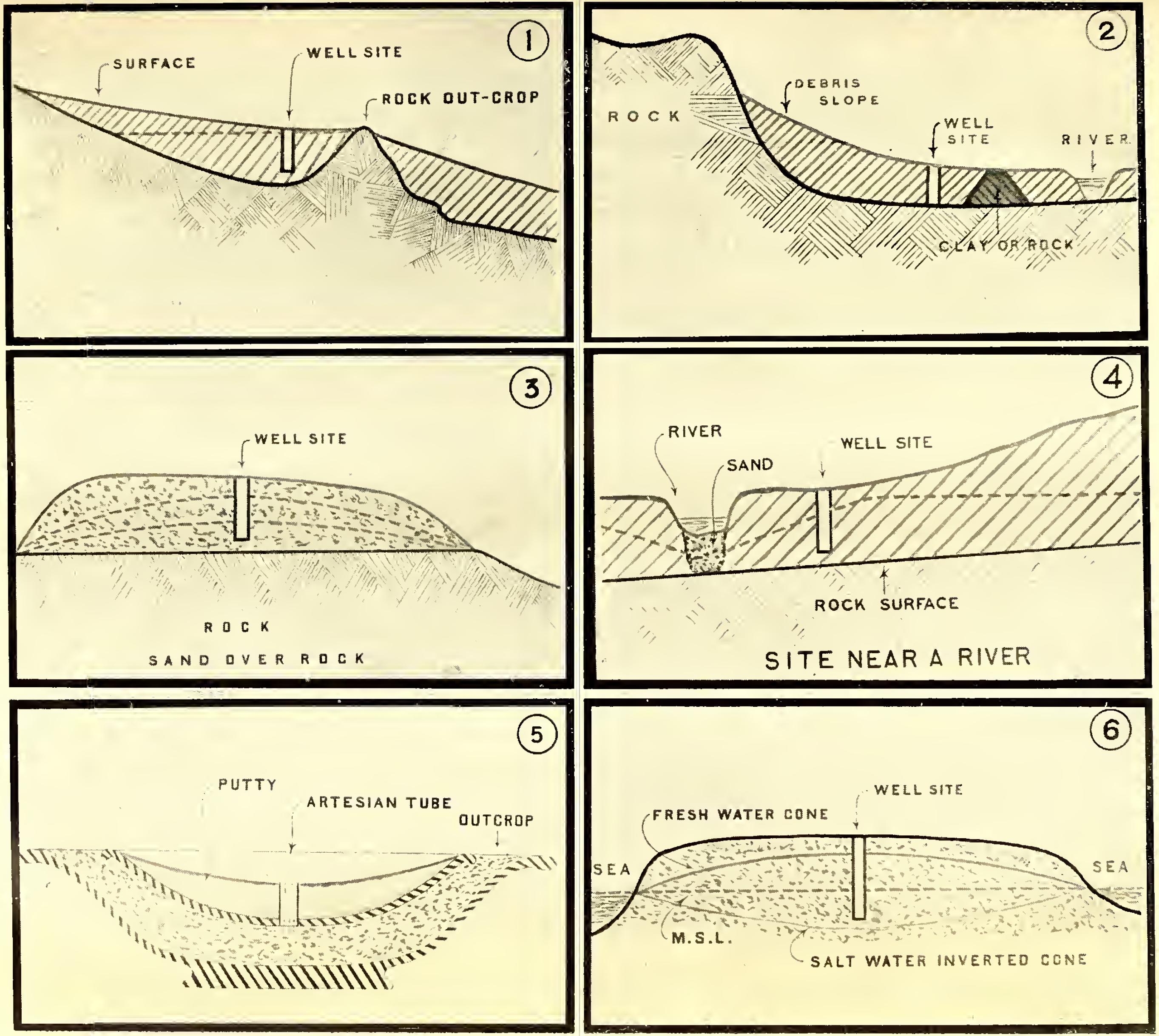
The question of water supply is so inseparably connected with agriculture that the following notes regarding "Wells" and the selection of sites for same may be of general interest.

2. In the northern climes, especially in North-Western Europe, the difficulties experienced by agriculturists in connection with water are mainly found in the disposal of the surplus supply. The rainfall, though perhaps not excessive in actual quantity as compared with tropical countries, is tolerably evenly distributed and the evaporation small. The soil—especially in districts where this question of surplus supply has to be considered—is retentive, and absorption is at a minimum. The result is that the water which falls on the surface in the form of rain has either to run off to natural drainage outlets or remain in excess on or near the surface. Artificial drainage then becomes necessary.

3. This leads up to one main point which has to be kept in mind when considering the question of the selection of sites for wells, namely, that, speaking generally, the source of all supplies of fresh water is found in rainfall. Artesian wells and springs are often credited with some magic power which enables them—like the traditional "brook" in the song—to "go on for ever," but on consideration it will be seen that even they (magic as they are!) must have some original source of supply or they would become exhausted.

4. When this water supply, in the form of rain, reaches the surface of the ground, it meets, in the case of the retentive soils mentioned above, one of the worst conditions to be found. In a short time the surface becomes saturated, and, if it has naturally steep slopes, the surplus water runs off into drainage channels, and thence to the rivers and is lost. There is only one worse condition, and this is in the case of bare rock, when the whole supply is lost, at least to the immediate vicinity.

5. The other and best extreme as regards conservation of the supply, occurs in the case of a pure sand soil, where nearly the whole of the supply is retained in certain cases. As these notes are written for the consideration of an Agricultural Society, the writer may be pardoned for dealing with the general question under consideration from the point of view of the agricul-


1
SURFACE
WELL SITE
ROCK OUT-CROP
2
ROCK
DEBRIS SLOPE
WELL SITE
RIVER
CLAY OR ROCK
3
WELL SITE
ROCK
SAND OVER ROCK
4
RIVER
SAND
WELL SITE
ROCK SURFACE
SITE NEAR A RIVER
5
PUTTY
ARTESIAN TUBE
OUTCROP
6
WELL SITE
FRESH WATER CONE
SEA
SEA
M.S.L.
SALT WATER INVERTED CONE

turist, and an endeavour will be made to treat the subject in a popular way. Now the bare rock or the purely sandy soil have not much in them to interest the agriculturist at first sight. He cannot grow crops on either, and he cares for nothing else. All the same, both these uninteresting looking objects may come in useful.

6. The function of a well is to supply water, and the suggestion which brought forth this paper was, it is believed, not wholly unconnected with the subject of "School Gardens," one which is dear to the heart of the Society's Secretary. The well is an important item in the school garden (or any other garden), and is required both for the supply of water to quench the thirst of the scholar when he has worked as hard as he is expected to work, and also that of the various plants which are grown. The quality of the water is important in the former case, and it may be briefly suggested that, all other things being equal, the site of any well, the water from which is to be used later on for dietetic purposes, should be selected, so that the natural surface drainage of the ground falls away in every direction, if possible, from the well, and in the case of, say, a house or school compound, the safest position for the well, having regard only to the question of quality in the water, will be found in the highest point of the ground. Manifestly in the case of sidelong ground the possibility or probability of contamination from the neighbouring higher ground must also be considered. This point seems almost too obvious to require notice, but the writer has seen many wells in private and public places so situated as to lead one to suppose that the main object in the original selection of the site had been to secure the maximum of pollution in the water.

7. The water which reaches the ground surface in the form of rain, assuming that the surface has a slope, will, in the case of bare rock, run down the slope until it meets a place where the rock has some "overlay"—more or less deep according to circumstances—of earth or soil. The latter may take the form of stiff and partly watertight clay, and in such a case the water cannot easily percolate into the soil, and tends to travel further on or near the surface. Such places are easily recognized, as the ground near the bare rock margin is always unduly wet after rains. To sink a well in such a position would be a mistake, as the probability is, the subsoil would be found relatively dry and waterless, possibly even at a depth approaching that of the rock surface.

It is not, however, very likely that such retentive clay would be found in this position, especially if the rock surface is steep, as the latter has nearly always undergone a process of partial disintegration, and the detritus so produced takes the form of gravelly or sandy soil, which quickly absorbs the water running off the rock surface.

All underground water has a tendency to travel to a place where it can repose at a lower level, and does travel to a greater or less extent due to the force of gravity. This travel of the water is arrested in various ways and in varying degrees. It may, in its underground progress, meet a bar of rock or watertight clay which it cannot pass, and then it must accumulate at this barrier until either its motion is entirely arrested, or until it flows again over the top of this underground dam, as it may be called, and finds its way to lower levels. In either case a sort of underground reservoir is formed, and if the depth below the surface be not too great, such a position is favourable for a well site. (See Diagram No. 1.)

In the case of the water flowing off bare rock, as described above, and sinking under the surface (at the rock margin) into a gravelly soil, it will continue to travel underground until it meets a clay or rock bar such as that described, and the former is very frequently found at the place where the ground surface flattens out into a plain or more gently sloping surface below some mountain or rock hill.

Rather a good instance of this is found in the case of Kurunegala rock (Diagram No. 2 shows the idea). The water which has been collected on its surface appears again on the surface of the ground lower down—but in this case relatively close by—in the form of springs, of which the "Rajapihilla" is perhaps the best known. There are, however, many others more or less well defined. There is evidently some watertight bar of rock or clay near the position of these springs which compels the water in its travel to reach the ground surface again. In most similar positions the probability is that the same phenomena would be found, and it would not be difficult to select a good site for a well.

8. Though not necessarily always true, it is still very often found that the ground, having regard to its surface and slopes, is imitated by the subsoil strata, that is to say, the planes of the surfaces of the latter are often found to

be roughly parallel to the ground surface. This is not to be wondered at, as these strata have been formed in the long process of time and at different periods.

Assuming that these conditions exist in any particular place, and that some of these strata are formed of porous water-bearing material and others are of a more or less watertight nature, and again that some impervious stratum is overlaid by a water-bearing soil, then one would naturally select the *hollows* in the ground surface rather than the elevations as sites where well-sinking would be likely to prove successful.

This is another of those cases where such a principle seems almost too axiomatic to require statement, but the writer has seen so many cases where the exactly opposite course has been taken, resulting in disappointment and loss, that it may perhaps be worth while to draw attention to the point. The probability of finding water moderately high up on the slopes of an elevation from which the ground falls away in every direction is so remote that it is certainly not worth while spending money on it.

9. Let us now turn to the case of the pure sand soil, the other extreme from the bare rock. There is no better form of storage reservoir—having regard to conservation of the water supply—than a deep bed of sand overlying a watertight stratum of clay or rock. Thus, in Holland, the sand dunes along the coast are a source of water supply for large cities and towns, but there the sea level takes the place of the underlying rock. The water which reaches this sandy bed, either directly in the form of rain, or by flow from some higher level, is retained there under the best conditions, and subject to the minimum of loss by evaporation and absorption, properly so-called.

The losses by percolation depend largely on the relative area of the sand bed, as compared with its depth and the depth of water supplied in a year, as replenishment, over the unit area. Also on the slope, if any, of the subsoil watertight stratum.

Where large areas of sand deposit are found they occur usually in level ground, and the substratum is similar. An exception occurs in the case of a deep sand bed in a river. The watertight, or partially watertight, substratum slopes downwards similarly to the sand bed surface, and when the water in the river has ceased to flow over the surface it still continues its travel downwards under the surface. A good site for a well can often be selected on the margin of such a river, and the water will be supplied by percolation laterally from the bed.

There is a certain amount of percolation, and consequent loss thereby, in even a very level sandy tract, as described above, under any ordinary conditions. If it be supposed that the watertight substratum and sand surface are absolutely level for a considerable area, but that the substratum curves upwards until it meets the surface of the sand all round at some distance from the centre of this area, then the travel of the water which falls in rain or is supplied otherwise over this area uniformly will be arrested, and the "water plane" or "surface of saturation," say the level of the free surface of water in wells sunk in various positions over the area, will be the same in each place. Such a case is rarely found, and there is usually some opening on one or more sides possibly all round by which the water can escape by percolation. This process goes on until the friction caused by the water having to flow between the grains of sand overcomes the action of gravity, which tends to make the water flow, and all motion is arrested. The water plane will then be found to represent a sloping surface, falling towards the outlets for escape, and varying in gradient according to the character of the sand as regards its coarseness or fineness.

Supposing, therefore, that this sand bed is 10 feet thick, and that the water in a well situated near the centre of the area in question stands at a level of 5 feet from the surface and 5 feet deep in the well, this depth will be gradually reduced to perhaps one foot or only a few inches in wells sunk near the margins of the area on the side or sides on which the water can escape by percolation.

It stands to reason, therefore, that the best site for a well in such positions is one *near the centre* of the sandy tract, or at least at the point or points most remote from the outlets for escape. (Diagram No. 3 illustrates this.) This seems to provide a contradiction to the remarks made previously about selecting a natural depression or hollow for a well site, as in actual fact the centres of these sandy tracts are frequently the highest points, and the selection of a well site at such places seems paradoxical. The subsoil conditions are, however, the most important to keep in view.

An interesting case of this nature is found in Mannar island, where the writer had on two occasions to make investigations for water supply. At the eastern (Mannar town) end of the island and on the south-western shore the winds of the south-west monsoon have thrown up sand dunes, and these extend inwards for, roughly, one-third of the width of the island and lie over the subsoil coral formation. The natural escape for the rain water by percolation is situated all along the shore margin, and the limiting level is that of mean sea. The surplus water after rains flows out to sea until the water plane takes its limiting slope, and fresh water wells can be sunk in the sand along the shore almost up to the wash of the waves. In addition, the fresh water surface in these wells actually rises and falls with the tides, as the flow is temporarily arrested (or decreased) at the time of high water.

The inland margin of this sand dune tract borders on a silty plain, where the percolation is partially arrested, so the best position (*i.e.*, the position where the greatest depth of fresh water can be obtained) for wells is on the inland border of the dune tract.

Similar conditions prevail at the other end of the island (Talaimannar), but there the whole width of the island is made up of sandy soil, and so, in plotting a contour map of the subsoil water levels, they will be found to represent curved lines roughly parallel to the coast line, and culminating in a point which is equidistant from the shore on the north, south, and west sides. This point represents the position of best supply from a well.

Before leaving this subject it may be mentioned that the loss by evaporation from the surface of sandy soil is only about one-fifth of that from the surface of water, and the actual relative losses by evaporation from water, earth, sand and other surfaces may be taken as approximately in the following ratios :—

Grass sod surface ...	1·92
Cereals	1·73
Forest	1·51
Water	1·00
Bare soil	0·65
Sand	0·20
Soil covered with forest leaves	0·07

It will be seen from these figures that the losses due to evaporation from sandy surfaces are only about one-third of those from bare earth surfaces, and about one-tenth of those from grass lands. As "evaporation" and the losses classed under this heading may account for 60 to 70 per cent. of the rainfall, it is important to bear this point in mind in the selection of well sites, having regard to the conservation of the available subsoil water supply.

Incidentally also this matter is of considerable interest to agriculturists in the consideration of the question as to what condition their ground surfaces should be kept in.

Well tilled, loose earth surfaces resemble the sand formation, and greatly decrease losses by evaporation. In the drier districts the tea planter who keeps his ground surface free of all grass and weeds and the soil loose would appear to be acting wisely in so doing, as he is helping to conserve the water supply for the roots of his plants. But this is perhaps a digression.

10. In the above paragraphs the extreme conditions have been dealt with, but by far the most difficult problem remains in the case of selection of well sites in districts where the ground surface is all composed of ordinary soils, is only very gently sloping, and gives no special indication of the subsoil formation. There may be no rock and no sandy soils for miles round. Speaking generally, such localities are not promising, and in many places the only course left is to take the risk and make a trial by either borings or pits.

When the writer was attending lectures in the University School of Engineering, an old Professor once made the remark (probably repeated to each successive class of students!) "always look out carefully for other men's failures as such failures are only unintended experiments." This is pretty sound advice, and it may be repeated here. In these difficult districts, where the surface of the ground gives no help in selecting a well site, the best course is to hunt round and find, if possible, some other person's success or failure. In the former case the water plane is in view, and the probability is that it extends some distance round, though this is not always true. If two or more existing wells show the water plane at moderate depths, then it is fairly safe to try a site in some position between them, and in lower ground if possible. If the water planes in two or more wells stand about the same level, the chances are all the better. Failing any existing wells, some indications may be given by examining the river or stream beds or water-courses in connection with a good topographical map (if such exists) of the district and the records of the nearest rainfall gaugings. If these water-courses are unduly numerous and their cross

sections appear unduly large for the catchment, then it would appear that a large proportion of the rainfall runs off by these channels and comparatively little is absorbed in the ground. There are some localities where these phenomena are very marked. If the beds of the water-courses are sandy, which they usually are in moderately flat country, and where no rock is found on or near the surface, then it may be well to sink pits in the sand (which costs little) and see if the underground water is still flowing. The result may be some indication of the porosity or otherwise of the subsoil formation. In any case a deeply cut river bed is in itself an elongated trial pit, which shows the formation down to this depth. If a fair supply of water is found, after a dry spell, in the sand bed, then it is fairly safe to sink a well alongside (as shown in Diagram No. 4); and if the sides of the river banks show no seepage and the bed is dry, this is a pretty safe indication that well sinking at moderate depths is useless in that locality. In South Africa farmers often provide a sort of artificial water supply to wells by throwing up low dams on lines transverse to the direction of the natural surface slope of the ground, the object being to form small tanks or reservoirs in which some of the surplus water, which would otherwise have run off the surface into the natural drainages, is held up. The wells are sunk on the lower side of these low dams, and the water plane is raised above the surface, on the upper side of the dams, and stands there in small lakes. This tends to raise the water plane on the lower side also by seepage and prolongs the supply in the wells.

A similar method is adopted in some of the very dry districts in India also, and the water which is thus stored for irrigation is not drawn off direct by sluices from the tanks, but is lifted from wells sunk below the bunds. The reason is that it is well known that where the water is so raised by manual labour it is not wasted, and a minimum is used.

The village and other tanks of Ceylon have the same effect in raising the water plane, and the landowners in very dry districts take care to plant their coconuts only under the bunds of tanks or channels. Where wells are sunk, their sites are invariably chosen in similar positions.

11. Any reference to wells generally leads up to the question of artesian systems, and perhaps a few remarks may not be out of place in this connection, as the popular notions regarding these are frequently tinged with the magical and supernatural.

The writer may be permitted to give a very homely illustration of an artesian system as follows. Imagine a large basin or chatty (the kind called "thattiya" in Sinhalese) partly filled with sand and then another smaller basin or chatty of exactly the same shape placed inside the bigger one and pressed down into the sand until the bottom reaches within, say, one inch of the upper surface of the bigger chatty, leaving about one inch in thickness of a layer of sand between the two chatties and all over the outer surface of the smaller chatty. Assume also that the size of the smaller chatty is such that when it rests on this one-inch thick bed of sand all round its top edge will be just level with that of the bigger chatty. Let the upper chatty then be filled with some watertight substance, such as putty, but the upper surface of this putty be hollowed out by a depression, which is about half the depth of the chatty (if completely filled). To make the whole appear more natural the larger chatty may be buried in the ground until its brim is just level with the surface. We have here a miniature artesian system, and the top edge of the sand is usually called the "outcrop."

If now a small tube equal in length to the height from the centre of the hollow formed in the putty to the sand at the bottom be inserted in the centre of the hollow formed in the upper surface of the putty, and this tube be pushed down until it reaches the smaller chatty and is passed through a hole drilled in the latter and into the sand at its lower end, then the water held up in the sand will rise in the tube, and under favourable conditions will begin to flow out at the top end and partly fill the hollow in the putty.

This is what happens in artesian systems, and the reason is because the "outcrop" of the water-bearing stratum of sand is higher than the bottom of the hollow formed in the surface of the putty. If the water supply to the sand "outcrop" is kept up to meet the loss in water drained off by the pipe, the process will continue indefinitely. Diagram No. 5 gives a rough idea of the system.) In actual nature the under- and over-lying watertight strata are formed of clay or some such material, and the water-bearing stratum lying between them may be sand or gravel or a mixture of both. The circle of the outcrop may be tens or hundreds of miles across, and one side may be depressed and lie deep below the surface, or the whole system may be depressed. In the case where the whole system lies deep below the surface, the water will not naturally rise to the

ground surface in a bore hole. It will only rise to a level approximating to that of the lowest point in the outcrop, and a water supply so obtained is only of practical value in extraordinarily dry countries such as parts of Australia. When the water has reached its maximum level in the bore, it may still lie hundreds of feet below the ground surface, and has to be raised by artificial means, such as "deep-well" pumps, which are generally costly to instal and operate. In the cases where one side only of the outcrop is depressed and the other side lies at a considerable elevation an artesian well may be possible and effective, delivering water with more or less pressure at the ground surface, but in such cases, speaking generally, the higher side of the outcrop must be relatively high compared to the position of the bore hole and also comparatively close. The water supply (by rainfall or otherwise) at the position of the upper outcrop must be abundant.

The occurrence of springs on the surface as described earlier in this paper is a condition which partly partakes of the nature of an artesian system. Sufficient has been said to indicate the general conditions, which are subject to innumerable modifications, and also to point to the fact an artesian system in such a position as, say, a small island or a promontory, is a practical impossibility, except on a very small scale, and then only in the region of high hills or mountains.

12. These notes, written as they are for the Ceylon Agricultural Society, would hardly be complete without a brief reference to the very remarkable—probably unique—conditions which prevail in the Jaffna peninsula, and are all the more appropriate, as referring to the district where intense cultivation is the order of the day, and where wells are to be found every few yards, though generally sunk and lined at very considerable expense to the landowners.

The following particulars about the "natural" wells—so called—will be interesting to those who are not already acquainted with them:—

There are three of these "natural" wells—possibly more—which are well known in Jaffna: the "Nilaverei" or Puttur well, the "Yama" well at Urelu, and the "Devil's well" ("Pe-kinarn") at Kurumbakattu. A description of the first will be sufficient, as they are all similar in natural formation.

The Puttur well resembles a small "keni," or bathing tank, such as is generally found at the temples. It is 48 feet long by 36 feet wide, with the usual ramped slope at one side leading down to the water.

The writer is unaware what the actual circumstances were attending the cutting of this well, but judging by appearances it would seem that those who were engaged on the work intended excavating the usual "keni" and finishing up with perhaps 3 feet deep of water. They would appear to have been unaware how "thin the ice" was—in this case the rock crust—and it can only be conjectured that this crust broke through and part or the whole of the bottom fell in! One is compelled to this belief, as otherwise it would have been difficult to get any men to undertake such dangerous work.

At all events the result is certain. This crust representing a thickness in all of, say, 14 feet, that is 9 feet of rock and 5 feet of clay overlay, was broken through and stood over a cavity filled with water, but of what dimensions nobody as yet knows. The total depth of water was measured by the writer, and amounts to 147 feet 6 inches, of which the top 80 feet or so is fresh water and the remainder salt.

The level of the water surface is practically invariable (only rising after heavy rains), and represents, of course, the ground water plane, which at this place and in dry weather stands at almost exactly 2 feet over mean sea level.

There are only a few inches difference between the levels of the water planes in the three "natural" wells mentioned above, and they are relatively almost exactly in proportion to the distances respectively of these wells from the sea at the nearest point, the greatest distance representing the highest level. It would appear therefore that the water plane is represented by a very flat cone with its apex at the most central point of this portion of the peninsula. It may also be taken as exceedingly probable that the margin between the salt and fresh water—at what may be called the "salt water plane"—takes the form of an inverted cone, with its apex situated at the same point and its base coinciding with the mean sea plane all round the coast. (Diagram No. 6 shows this.)

The formation is all limestone rock, which is perforated in a most remarkable way with holes and cavities of all sizes, and these represent the underground storage space. Investigations some years ago in connection with the proposed Jaffna water supply showed that these conditions were uniform all over the north end of the peninsula, and

the practical result, which is well known to the inhabitants, is that well sinking is an absolute certainty, and, given a knowledge of the surface levels, the depth to which a well must be sunk is known to an inch.

Also, the flow from a well or any similar cavity sunk below the water plane is exactly in proportion to the superficial area of the cavity at a given average depth below the water plane.

It may be useful to note that for small depths below the water plane the flow from the Jaffna rock formation in a well of 14 feet diameter and 25 feet depth to the water surface from ground level is such that one ordinary "well sweep" cannot reduce the water level more than about 4 feet when kept continually working, and this represents a total quantity of 17,000 gallons in a 10-hours' working day, equal to, say, 2,700 cubic feet of water, or, say three-quarters of an inch deep over an acre.

13. In conclusion, it may be said that the term "well" is one which is used to describe any cavity in the earth's surface which is sufficiently deep to reach the water plane, and passes through all the various phases between the mere water hole and the tube bore, embracing also all the usual variations in size, shape, and methods of lining with timber, brickwork, masonry, &c.

To enter into a description of all these technicalities is beyond the scope of such a paper as this, but a general principle which must always be kept in view may here be stated, namely, that the larger the superficial area of the opening below the water plane, the greater will be the supply obtainable in any one place, and that most wells require either partial or complete "steining" or lining with brick or masonry.

When the quality of the water and freedom from contamination is important, then this masonry lining should be built solid in mortar for several feet below the surface, and without mortar when the water plane is reached. If the subsoil below the water plane is pure sand, it may be necessary to plug the bottom of the well with concrete to prevent the sand being drawn up into the well, and possibly the sinking of the lining as a consequence, and this particularly where large quantities of water have daily to be extracted.

Care should, however, be taken to avoid following the precedent supplied by a case which came to the writer's knowledge some years ago, when on examining a well (masonry lined) situated in a position where the subsoil was most undoubtedly water-bearing, it was found that the bottom of the well had been plugged with concrete, as above described, but in addition, to make matters more comfortable, the whole of the masonry lining from top to bottom had been built in brickwork in cement mortar, thereby effectively excluding all entrance of water, and the inside being as dry as a drum. The writer gained considerable "kudos" locally, added to a subtle suspicion of the supernatural, by making the water flow. This was not a difficult operation, involving only the boring of three or four holes in the concrete bottom and firing a dynamite cartridge in one of them.

R. W. SMITH.

Trincomalee, March 25, 1911.

THE CEYLON AGRICULTURAL SOCIETY.

STATEMENT OF RECEIPTS AND EXPENDITURE FOR 12 MONTHS ENDING DEC. 31, 1910.

RECEIPTS.		Amount. Rs. c.	Total. Rs. c.
Balances at Bank of Madras, &c., December 31, 1909		—	43,073 93
Members' Subscriptions :—			
Local subscriptions for 1908		257 0	
Do 1909		763 0	
Do 1910		4,059 40	
Do 1911		444 0	
Do 1912		16 0	
Foreign subscriptions	394 50		
Less paid to *Ceylon Observer* ...	295 87		
		98 63	
Life members' subscriptions		50 0	
			5,688 3
Government grant for 1910 ...		—	30,000 0
Interest :—			
On Bank of Madras account		—	788 52
Total ...			79,550 48

PAYMENTS.	Rs. c.	Amount. Rs. c.	Total. Rs. c.
General Expenditure :—			
Organizing Vice-President ...	3,000 00		
Secretary ...	3,000 00		
Clerks and peons	2,715 37		
Agricultural Instructors ...	2,326 63		
		11,042 0	
Stationery		241 98	
Postages and telegrams ...		722 44	
Office furniture ...		230 22	
Bank charges and commission		17 95	
Micellaneous petty expenses		426 10	
Auditors' fee for 1909 accounts		150 0	
Advertising		3 0	
			12,833 69

PAYMENTS.—(*Continued.*)	Amount. Rs. c.	Total. Rs. c.
Brought Forward ...		12,833 69
Travelling Expenses:—		
Secretary, Ceylon Agricultural Society ...	1,207 48	
Agricultural Instructors ...	4,090 91	
Show Judges, &c. ...	86 76	
Organizing Vice-President and Staff	464 74	
		5,849 89
Tropical Agriculturist and Magazine of Ceylon Agricultural Society:—		
Printing English Magazine	5,223 24	
Sinhalese Magazine:—		
Editor's fee Rs. 450 00		
Printing, Postages, &c. ,, 459 21		
Rs. 909 21		
Less subscriptions received ,, 685 70		
	223 51	
Printing Tamil edition	200 0	
		5,646 75
Agricultural Shows:—		
Indian exhibits ...	256 95	
Cost of medals, &c. ...	257 50	
Grants to Henaratgoda and Ibbagamuwa Shows ...	100 0	
		614 45
Sericulture Experimental Farm:—		
Coolies' wages... ...	417 0	
Cadjans for roof ...	54 58	
Implements	56 25	
Cocoons	12 3	
	539 86	
Less sale of cocoons 157 73		
Less rent for farm, 1910 ... 10 0		
	167 73	
		372 13
Experimental Gardens:—		
Balangoda, coolies and wages, &c.	212 50	
Balalla, wire fencing, implements, &c. ...	97 62	
Grants to Rajakadaluwa, Kalalgama, and Bandaragama gardens ...	350 0	
Grant to school gardens ...	500 0	
		1,160 12
Carried Forward		26,477·03

PAYMENTS.—(*Continued.*)	Amount. Rs. c.	Total. Rs. c.
Brought Forward ...		26,477·03
Seed Store at Government Stock Garden:—		
Show boxes	70 0	
Seed bin	30 0	
Seed bags	15 67	
		115 67
Sundry Payments:—		
Agricultural implements...	—	154 1
Seed Supplies:—		
Excess purchases over sales	—	38 36

	Purchases. Rs. c.	Sales. Rs. c.
Vegetable seeds	277 32	281 75
Paddy ...	188 61	191 25
Cotton ...	33 86	120 27
Ginger ...	55 10	2 45
Pila, wild indigo, &c. ...	25 19	48 75
Grafted plants	706 44	670 25
Congayam grass	12 44	—
Soy beans ...	42 58	—
Castor ...	6 60	0 50
Guvar ...	12 13	—
Ground-nuts ...	64 81	64 31
Durian ...	17 63	—
Tobacco ...	0 56	—
Sundries ...	35 82	23 75
Sorghum and fodder ...	3 50	40 95
Total ...	1,482 59	1,444 23

(Excess purchases, Rs. 38·36)

	Amount. Rs. c.	Total. Rs. c.
Tobacco Experiment:—		
Coolies' wages, &c. ...	5,993 93	
Salary of Superintendent, &c.	4,229 16	
Salary of conductor ...	458 80	
Travelling expenses ...	522 23	
Cost of sheds	2,239 94	
Cost of guano	323 0	
Sundry purchases ...	314 75	
	14,081 81	
Less Government contribution	1,750 0	
		12,331 81
Balances in hand:—		
At Bank of Madras ...	40,375 10	
Stock of stamps ...	58 50	
		40,433 60
Total ...		79,550 48

We certify that we have prepared this account of Receipts and Payments from the books of the Society, and that to the best of our belief it is correct.

FORD, RHODES & CHURCH,
Accountants.

Colombo, May 10, 1911.

KALUTARA AGRI-HORTICULTURAL SHOW.

The above show was held on Tuesday the 30th May, 1911, at the Kalutara Kachcheri. The show was confined to the Kalutara Totamune only. Considering the unusual dry weather during the year, and this being the first show of its kind in the district, a better show could not have been expected.

Class I. FRUITS.—This class was fairly full and there was good collection of oranges, jak, pineapple, and papaw. The exhibits of plantain and mangosteen should have been very much better.

Class II. YAMS.—The exhibits in this class were poor in quality as well as in quantity. There were, however, a few good exhibits of cassava and sweet potatoes.

Class III. VEGETABLES.—Fairly good; but competition poor. Kalutara being a district where vegetable cultivation is carried on, the exhibits should have been very much better.

Class IV. DAIRY PRODUCTS.—Good average samples of milk, &c., were shown.

Class V. COMMERCIAL PRODUCTS.—This class was very full, and there was good competition. Coconut oil was specially well represented.

Class VI. LIVE STOCK.—A poor class.

Class VII. NEEDLE WORK.—Not particularly good.

Class VIII. INDUSTRIAL PRODUCTS.—Poor.

Class IX. SWEETMEATS AND PRESERVES.—Fair.

Class X. SCHOOL GARDEN PRODUCTS.—There were three competitors, and Tantirimulla school was awarded the prize.

L. A. D. SILVA,
Agricultural Instructor.

MATUGAMA AGRI-HORTICULTURAL SHOW.

The above show was held at the Rest-house grounds on the 27th ultimo, and was opened by Mr. G. F. Plant, the Assistant Government Agent, Kalutara. The shed put up for the occasion was rather too small.

In spite of the wet weather which continued for two days and kept away many villages, a fairly large collection of exhibits representing all classes was displayed. I was led to understand that this show was better in quality and quantity of exhibits than the last show held at Bellana in this Korale. From this it would appear that cultivation is improving in this Korale.

Section 1. FRUITS.—This was the second best class in the show. Specimens of Mangosteens, Pineapples, Mangoes, Oranges, Pumelos, Papaws, Limes and Kamarangas were particularly good. Mandarian Oranges, Pomegranate, Anona, Jambus, Nam-nams and Plantains were rather poor.

Class 2. YAMS.—In this class Cassava, Sweet Potatoes, Arrowroot, Raja-ala and Gahala made a good show.

Class 3. VEGETABLES.—This class was the best both in quality and quantity of exhibits. Melons, Ash Pumpkins, Gourds, Luffas, Kohila, Bandakka, Capsicum Chillies and Biling were particularly good. There was a specimen of a large kind of bitter gourd measuring about eighteen inches in length.

Class 4. DAIRY PRODUCTS.—This class, comprising Milk, Curd, Ghee and Eggs was tolerably good.

Class 5. COMMERCIAL PRODUCTS.—The exhibits in this class were satisfactory. Specimens of Coconut Oil, King Coconut Oil, Honey, Paddy, Pepper, and Coconuts were particularly good.

Class 6. LIVE STOCK.—A few pens of native fowls and four native bulls made up this class.

Classes 7, 8, 9. NEEDLE-WORK, INDUSTRIAL PRODUCTS, AND SWEETMEATS.—These classes were fairly represented.

Class 10. SCHOOL GARDEN.—Meegahatenne School carried away the shield for the best garden in the Korale. Eight schools competed for the best collection of school garden produce, and the prize was awarded to Kevitigala School. Bellana and Matugama deserves honourable mention for the collection displayed.

June 5, 1911. N. M. JAYASURIYA.

CAINGINS (CHENAS).

(From the *Philippine Agriculturist and Forester*, Vol. I., No. 3, March, 1911.)

By general consent, Philippine agriculture is under a curse. General consent is not proof, and in this case a good argument can be made against it. But assuming that the curse is real, there are three candidates for the place—ignorance, lack of draft animals, and the caiñgin. The caiñgin is land cleared of woody vegetation and used for crops.

After producing two or three crops, or sometimes only one, it is abandoned. This system of agriculture is common throughout the eastern tropics, and at least in parts of the New World as well. It is very popular with poor people who like to be their own masters, and in great disfavour with the State.

The inducement to make caiñgins is well illustrated by the cut on the opposite page.* The caiñgin is comparatively free of troublesome weeds, and is exceedingly fertile. The streak of very thrifty maize in the picture was a hedge; the remainder of the field on both sides was chiefly occupied by cogon (illuk). In the Philippines, these hedges gradually widen, sometimes to as much as ten meters; then they are cleared, and present in large measure the advantages of real caiñgins.

After a time weeds enter the caiñgin, the ground packs, the temporary exuberance of fertility wears out, and it becomes easier, with the implements available, to secure a given yield by clearing a new plot. The old clearing goes back to forest almost immediately if it is in the forest, but to grass first if there is brush and grass land about it. Here enters the interest of the State. In the Philippines it is in the interest of the State to have all, or nearly all, of the good agricultural land in permanent agricultural use. But the forest wealth is the wealth of the whole people, and the whole people cannot afford to have the forest sacrificed for the sake of a couple of crops. It takes many years for the forest on a caiñgin to become valuable again.

Still, the best thing about an abandoned caiñgin is the chance that it will return to forest. If it is occupied at first by grass *and there are no fires*, brush will smother the grass in a few years, and trees will in turn smother the brush, quickly or slowly according to the nearness of seed-bearing trees. If there are fires, they will kill most kinds of brush, but will not injure the cogon. As the result of fire, following caiñgins, for fire rarely hurts the tropical forest at all,—there are great grass areas in the Philippines. And these grass lands not only do not constitute any wealth at all for the people, but they injure the neighbouring cultivated land in several ways.

In the first place, forests the world over serve to conserve and regulate the water supply. In a study of conditions in four Wisconsin towns, F. A. Shriner and the writer showed a decade ago that a decrease in the forest from 27% of the area to 6% resulted in the drying up of 65·5 miles of creeks, and a decrease to about one-third in the flow of water. The rest of the water escapes in floods, doing damage instead of being useful. In the last number of this magazine mention was made of aridity in Mexico, resulting from deforestation. The floods of Tarlac and Pampanga have the same cause. The forest is a protection against wind and dry air, as well as against floods and dry creeks.

And then there are the locusts. They do not breed in cultivated land, and they do not breed in the forest. But so long as men make and leave waste land which is not forest and not in cultivation, we need not hope to be without them.

E. B. C.

* Not reproduced.

Correspondence.

CITRONELLA OIL INDUSTRY OF CEYLON.

Galle, 27th May, 1911.

DEAR SIR,—In the April number of your valuable magazine is an interesting article on Citronella Oil by Mr. N. Wickremaratne.

May we be allowed to comment on the first and last paragraphs? The former states that "as a result of the attention given to this matter (viz,, standard of purity), recent shipments to London have fetched better prices." This is hardly in accordance with facts, as the present value of Citronella oil in London is 10d. per lb., which is as low a price as has prevailed for some years. In his last paragraph Mr. Wickremaratne states that the average yield of an acre of the grass is 68 lbs. of oil per annum.

Taking the present value as 54 cts. per lb. this gives Rs. 36·72 gross. After allowing for reaping, cart-hire, distilling, &c., this would leave little or nothing for the cultivator, whereas, we believe, that we are correct in saying that the oil can be sold without a loss at somewhere near 37 cts. per lb.

Perhaps Mr. Wickremaratne will give us further details?

Yours faithfully.
CHAS. P. HAYLEY & CO.

[Mr. Wickremaratne admits that he was not correct in saying that better prices were fixed; what he intended to convey is that during greater part of last year there was a slackness in the Ceylon oil trade; but that, as the result of greater attention to the question of purity, there was a brisker market.

He, however, is not inclined to concede that his estimate of average yield of oil per acre is too low. He is supported in this opinion by the figures given by a practical planter published in the "*T.A.*" for May, 1906.—ED.]

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 24th May, 1911.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ...	70s a 75s
Zanzibar & Hepatic ,,	Common to good ..	40s a 72s 6d
ARROWROOT (Natal) lb.	Fair to fine ..	8d a 9d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ...	£6 15s a £6 17s 6d
Bombay bleached ,,	Fair to good	£7 10s a £7 15s
,, unbleached ,,	Dark to good genuine ..	£5 15s a £6 7s 6d
Madagascar ,,	Dark to good palish	£6 10s a £7
CAMPHOR, Japan ,,	Refined	1s 6½d a 1s 8½d
China ,,	Fair average quality ...	155s
CARDAMOMS, Tuticorin	Good to fine bold	2s 8d a 3s 2d
	Middling lean	2s 3d a 2s 6d
Tellicherry	Good to fine bold ..	2s 9d a 3s
	Brownish	2s a 2s 6d
Mangalore ,,	Med brown to fair bold	2s 6d a 3s 9d
Ceylon. Mysore ,,	Small fair to fine plump	1s 8d a 3s 2d
Malabar ..	Fair to good ..	1s 10d a 2s
Seeds, E. I. & Ceylon ,,	Fair to good ..	2s a 2s 1d
Ceylon Long Wild ,,	Shelly to good ..	6d a 1s 6d
CASTOR OIL, Calcutta ,,	Good 2nds .	3¾d
CHILLIES, Zanzibar cwt.	Dull to fine bright ...	40s a 45s
CINCHONA BARK.—lb. Ceylon	Crown, Renewed	3⅜d a 7d
	Org. Stem	2d a 6d
	Red Org. Stem	1⅜d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts per lb.	Good to fine quill	6½d a 1s 5d
2nds	,, ,,	5¾d a 1s 4d
3rds	,, ,,	5d a 1s
4ths	,, ,,	4½d a 8½d
Chips, &c..	Fair to fine bold	2¼d a 3d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1s 3d
Amboyna ..	Dull to fine	9d a 10d
Ceylon ..	,, ,,	9d a 10d
Zanzibar	Fair and fine bright	7¼d a 7½d
Stems ..	Fair	3d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	70s a 113s
Native	Good ordinary	
Liberian ,,	Fair to bold	60s a 65s
COCOA, Ceylon Plant. ,,	Special Marks	70s a 85s
	Red to good	63s a 69s
Native Estate ,,	Ordinary to red	40s a 60s
Java and Celebes ,,	Small to good red	25s a 77s
COLOMBO ROOT ,,	Middling to good	30s a 35s
CROTON SEEDS, sift. cwt.	Dull to fair	47s 6d a 55s
CUBEBS ,, ,,	Ord. stalky to good	150s a 160s
GINGER, Bengal, rough ,,	Fair	35s nom.
Calicut, Cut A ,,	Small to fine bold	80s a 85s
B & C ,,	Small and medium	60s a 70s
Cochin Rough ,,	Common to fine bold	40s a 45s
	Small and D's	40s
Japan ,,	Unsplit	35s
GUM AMMONIACUM ,,	Sm. blocky to fair clean	40s a 67s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£15 a £16
	,, ,, little red	£12 a £14
	Bean and Pea size ditto	75s a £12 10s
	Fair to good red sorts	£7 10s a £10
	Med. & bold glassy sorts	£5 a £7
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d
Turkey sorts ,,		42/6 a 57/
Ghatti ,,	Sorts to fine pale ...	20s a 42s 6d nom.
Kurrachee ,,	Reddish to good pale ...	20s a 30s ,,
Madras ,,	Dark to fine pale ...	15s a 25s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£17 a £18
	com. stony to good block	25s a £13s
KINO	Fair to fine bright	9d a 1s 2d
MYRRH, Aden sorts cwt	Middling to good	55s a 60s
Somali ,,	,, ,,	50s a 52s 6d
OLIBANUM, drop ,,	Good to fine white	45s a 50s
	Middling to fair	35s a 40s
pickings ,,	Low to good pale	12s 6d a 27s 6d
siftings ,,	Slightly foul to fine	20s a 22s 6d
INDIA RUBBER lb.	Fine Para bis. & sheets	5s
	,, Ceara ,, ,,	4s 7d
Ceylon, Straits, Malay Straits, etc.	Crepe ordinary to fine..	4s 11d a 5s 2d
	Fine Block ..	5s 2d
	Scrap fair to fine ..	3s 10d a 3s 11d
Assam	Plantation ..	4s 1d
	Fair II to ord. red No. 1	3s a 3s 3d
Rangoon	,, ,,	2s 2d a 3s

	QUALITY.	QUOTATIONS
INDIARUBBER. *(Contd.)*		
Borneo	Common to good	2s a 2s 4d
Java	Good to fine red ..	2s 9d a 3s
Penang	Low white to prime red	2s a 2s 8d
Mozambique	Fair to fine red ball ...	3s 10d a 4s 3d
	Sausage, fair to good ..	3s 9d a 4s 1d
Nyassaland	Fair to fine ball ...	3s 8d a 4s
Madagascar	Fr to fine pinky & white	3s 2d a 3s 3d
	Majunga & blk coated ..	2s 2d a 2s 7d
	Niggers, low to good ..	9d a 2s 10d
New Guinea	Ordinary to fine ball ..	2s 9d a 3s 9d
INDIGO, E.I. Bengal	Shipping mid to gd violet	3s a 3s 8d
	Consuming mid. to gd.	2s 8d a 2s 11d
	Ordinary to middling	2s 5d a 2s 8d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 2d a 2s 6d
	Low to ordinary	1s 6d a 2s
	Mid. to fine Madras	None here
MACE, Bombay & Penang per lb.	Pale reddish to fine	2s 6d a 2s 8d
	Ordinary to fair	2s a 2s 6d
Java	,, ,, good pale	2s a 2s 6d
Bombay	Wild	4d a 5d
MYRABOLANES, cwt	UG and Coconada	4s 6d a 5s
Bombay ,,	Jubblepore	4s 6d a 6s 3d
	Bhimlies	5s a 6s 6d
	Rhajpore, &c.	4s 6d a 5s 9d
Bengal ,,	Calcutta	5s 6d a 6s
NUTMEGS— lb.	64's to 57's	1s a 1s 6d
Singapore & Penang ,,	80's	7½d
	110's	5¼d
NUTS, ARECA cwt.	Ordinary to fair fresh	17s 6d a 20s
NUX VOMICA, Cochin	Ordinary to good	8s 6d a 9s 6d
per cwt. Bengal	,, ,,	7s a 7s 6d
Madras	,, ,,	7s a 8s 6d
OIL OF ANISEED ,,	Fair merchantable	4s 9d
CASSIA ,,	According to analysis	3s 4d a 3s 8d
LEMONGRASS ,,	Good flavour & colour	3⅜d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2d a 1s 4d
CITRONELLE ,,	Bright & good flavour	11d
ORCHELLA WEED—cwt		
Ceylon ,,	Fair ...	10s
Madagascar ,,	Fair ...	10s
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair ...	4½d a 4¾d
Ceylon ,, ,,	,, to fine bold heavy ..	3¾d a 5d
Singapore ..	Fair	4⅛d
Acheen & W. C. Penang	Dull to fine	3¾d a 4d
(White) Singapore ,,	Fair to fine	6⅞d a 8d
Siam ,,	Fair	7d
Penang ,,	Fair	6½d
Muntok ,,	Fair	7½d
RHUBARB, Shenzi ..	Ordinary to good ...	1s 2d a 2s 6d
Canton ..	Ordinary to good ..	10d a 1s
High Dried..	Fair to fine flat ...	8½d a 9½d
	Dark to fair round ..	5½d a 7½d
SAGO, Pearl, large ...	Fair to fine	18s a 19s
medium ..	,, ,,	17s a 18s 6d
small ...	,, ,,	14s a 15s
SEEDLAC cwt.	Ordinary to gd. soluble	52s 6d a 72s 6d
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 7d
	Fair greenish	2¼d a 4d
	Commonspeckyand small	1¼d a 2d
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ...	62s 6d a 150s
Bombay ,,	,, ,, Nom.	45s a 150s
Mergui ,,	,, ,, ,,	£10 2/6a £12 2/6
Manilla ,,	Fair to good ..	£7 7/6 a £13 5s
Banda ,,	Sorts	25s a 30s nom.
TAMARINDS, Calcutta...	Mid. to fine bl'k not stony	10s a 12s
per cwt. Madras	Stony and inferior ..	4s a 5s
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold ..	10s a 33s
	Pickings ..	8s a 23s
TURMERIC, Bengal cwt.	Fair	20s
Madras ,,	Finger fair to fine bold bright	26s 6d a 2s 9d
Do. ,,	Bulbs	22s 6d
Cochin ,,	Finger ..	19s
	Bulbs ..	14s
VANILLOES— lb.		
Mauritius ... 1sts	Gd crystallized 3½ a 8½ in	14s a 19s
Madagascar ... 2nds	Foxy & reddish 3½ a ,,	13s a 15s 6d
Seychelles ... 3rds	Lean and inferior ...	12s 6d a 13s
VERMILLION ..	Fine, pure, bright .	3s
WAX, Japan, squares	Good white hard ...	41s 6s

THE SUPPLEMENT TO THE

Tropical Agriculturist and Magazine of the C. A. S.

Compiled and Edited by A. M. & J. FERGUSON.

No. 1.] JULY, 1911. [Vol. IX.

CEYLON'S PALM PRODUCTS.

THE HALF YEAR'S RECORD.

Is a Boom Coming?

The year, as regards palm products, has, so far, been a very remarkable one. When oil and copra prices began to fall, from the highest point ever reached, this began to help the desiccating mills, which have now, twice in their history, been able to compete with the all-powerful copra man in securing nuts.

Take *Oil* first. This seemed rivetted at £36 per ton in London for months, and only towards the end of the second quarter did it rise to £38. The demand for our oil must bave been poor. This, some in tho trade put down to the new love, Soya bean. However that may be, the fact remains that there was a considerable falling off in export up to 30th June of no less than *82,463* cwts., as compared with the same date last year. The lower price paid for oil certainly pointed to eitber tbe soapmakers going slow, or to their striking other and cheaper oils, that of the soya bean being probably one of them. Crushing has, however, gone on very briskly in most of our local oil mills.

The depressed price of oil reflected on *Copra*, resulting in a fall of no less than 26½ rupees per candy. The lowest price Estate Copra fetched was about Rs. 67. With oil at £36 in London, driers could not pay the price the mills were able to, so that Desiccating Mills in some districts were actually flooded with nuts. It paid the copra men better to send their nuts to mills rather than to dry them. We had sent away to date only 147,189 candies against 310,668 candies last year, or 163,479 candies less. Today copra stands at over Rs. 76·50 a candy in Colombo. It may, however, go higher, after our big nut crops are over, say, at the end of August. Then, from all we can gather, nuts, are to be very scarce. They always are in the last quarter, but particularly so will this be the case this year. Then copra drying will be sure to fall off. The high price of copra we understand caused a considerable falling off in the manufacture of coconut butter, or Palmin, last year in Europe. This, no doubt, had something to do with the poorer demand for our copra, the price of which was bonnd to give way, we think. Our shipments of copra this year will probably look very small as compared with those from the American Colony, the Philippine Islands, with its huge export of copra, and little or no oil. If, however, we add the nuts which we convert into copra. as also those we annually turn into over 28,000,000 lb. of Desiccated, not forgetting our nuts in shell—some 16,000,000—exported, we fancy the Philippine total annual nut crop would not show up so well. The effect would be greater if we could calculate our local consumption of nuts, though, to be sure, the Filipinos consume nuts too.

As regards *Desiccated*, the year opened witb 23 to 24 cents for this, very fair prices considering the very high price and the scarcity of nuts. But still, with better crops, and slightly cheaper nuts, mills did much more work in tbe second quarter. Some of our Desiccating Mills had to shut down, while others went very slow, owing to continuous drought and very great scarcity of water, while nuts came tumbling in in greater quantity than they could cope with. Fortunately sugar was cheap over the period, and, that, togetber with June being Coronation month, of course, meant that confectionery, cakes and biscuits had to be made in unusually large quantities to help to feed the great London multitude. Up to Juno 29th we shipped no less than 11,438,925 lb. against 9,893,415 lb. in the first half of last year or *1½* million lb. in *excess*; the price now stands at 22½ cents to 23 cents Colombo delivery.

There is a falling off in *Poonac*, strange to say, of over 50 per cent. This can, we think, only be accounted for by the very high price of it,

owing to the high price of copra and nuts. Probably the Home and Continental Crushing Mills were able to produce it more cheaply than Ceylon could supply it. But it looks as if this year is to be one of the poorest in the decade for this famous fodder.

We did fairly well with our *Nuts in shell* for the half-year, 7,604,329 nuts were sent away in shell, against 5,805,647 in 1910. Crops have been satisfactory in quantity. The kernel, however, as must be expected, with five consecutive years of half our average rainfall, in our best nut districts, was very poor. It took fully 3¼ nuts, all round, big and little, to make a pound of desiccated, while, in many cases, it required fully *1,400* to *1,500* all round, to produce a candy of first quality estate copra. There are very few nuts on the trees for the end of this year, and we hear on all sides that nuts are to be very short September to December, and, in fact on into January, February, March, which is always our *shortest crop period*.

With *yarn* and *fibre* the mills worked on the whole six months, save when water supply failed, which it did at a good many mills. Several however, had to shut down. There were two reasons for this. The first was that husk went to very abnormal prices. The second was that there was no water in the tanks for retting. This was doubly unfortunate in the face of the *best* prices the mills ever saw, the best bristle fibre reaching R11, while mattress fibre was worth R3·90 at buyers' stores, Colombo.

Now with these prospects of very short nut crops we may well ask if there is to be a "boom" in Coconut products. Last mail seemed to bring expectation of this, especially in "Copra." We attract attention to Mr. Wicherley's paper in the "Rubber World" reproduced elsewhere, which is, on the whole, a carefully compiled statement, based, we should think, on information gathered from Ceylon authorities. But apart from this, the local rumour is that there is a great deficiency in this year's supply of Copra. If this is so, there is a good time coming for all interested in coconut plantations and gardens now in bearing.

The following details of Copra Exports for 1911 are kindly supplied us by Messrs. Freudenberg & Co., and will be studied with interest:—

EXPORTS OF COPRA, JANUARY TO MAY, 1911.

TONS.

	Jan.	Feb.	Mar.	April.	May.*	Total.
Ceylon	846	918	1108	1818	953	5643
Java	7167	8064	6017	4858	5772	31878
Singapore	4651	2291	4743	5458	5819	22962
Penang	1560	1110	1940	2375	1530	8515
Cochin	309	602	1127	1520	3785	7343
Padang	1045	783	967	295	1006	4096
Macassar	2352	1891	3299	1909	3184	12626
Molluken	5786	2023	5898	4056	4438	22201
Manila & Cebu	5700	5200	4500	9000	6000	30400
	29416	22882	29599	31280	32487	145664

From figures published last month the total shipments of copra from the Dutch East Indies, Straits and Singapore, Ceylon, and the Philippines for the period January to May, 1910, were given as 162,315 tons against the total for these months of 145,664 tons represented above.

* Provisional.

COCONUTS LANDS: THE COPRA INDUSTRY.

IS A BOOM COMING?

BY WILLIAM WICHERLEY, F.R.H.S.

It is common knowledge that some of the shrewdest brains in the City have for some months now been concentrated on the problem which is at present disturbing the edible oil industry all over the world—viz., shortage of supply, and the consequent certainty of an enormous increase in the price of the raw material, in the category of which copra, the product of the coconut, stands first and foremost.

The finest copra comes from the Malabar Coast, the next in esteem being produced in Ceylon, whilst that from the Malay States, Dutch East Indies, Philippines, and the South Sea Islands follows in their stated order. So far as the outturn from the South Seas is concerned, this, as it applies to the European market, may be left out of count, since the Australian and American demand greedily consumes everything offered from that quarter.

About three years ago, Messrs Lever Bros., of Port Sunlight, embarked on the heroic endeavour to direct this trade to England, but the attempt is stated to have been a complete failure. After sinking thousands of pounds in the enterprise, this firm decided early in the present year to cut their losses, and leave the Solomon Islands and its copra trade severely alone. The cost of collection was found to be enormous, often amounting to over £50 per ton, at a period when copra could be purchased in England at £22, delivered! Messrs Lever Bros. are now turning their attention to the palm-nut forests of the Belgian Congo in the endeavour to obtain supplies. The same uneasiness is manifested among other large consumers, who, for the time being, are obtaining some assistance from the soya bean. This cannot last, however, for many reasons, chief of which is the ever widening demand for this legume as a food among the Asiatic races. Experts recognise that the only solution of the difficulty is the consolidation of the copra industry into channels which would ensure continuity of supply, together with a price always moving in consonance with that of the ruling market. To obtain this desideratum, it is absolutely necessary to secure the means of output, which can only be accomplished by out and out purchase of the lands which yield the product, or the financing of the means of production. The latter would be the readier, if the more risky, means of operation, but it has drawbacks which have before now frightened away investors. The only difficulty in the way of purchase is to persuade the native owners to ask a reasonable price for their properties. For the moment, thanks to fictitious inquiries from irresponsible people, they entertain the notion that Europeans are tumbling over each other in a desire to pay anything from fifty to a hundred years' purchase for coconut lands in bearing, whereas a reasonable figure is anything between six and twelve years' purchase of the certified net profits, averaged over a period of five years.

There are plenty of lands to be had at these rates, but purchasers must be prepared with hard cash—money down always impresses the Ceylonese particularly—and not waste time in attempting share purchase considerations, debentures and the like, for this never leads to anything but "talkee talkee," in which the native delights, but has not the slightest intention of converting into a business transaction. Investors should remember that money talks in the East louder and to more purpose, than in any other part of the world.

In arriving at the approximate value of an estate, purchasers should consult a European valuer. Native proprietors are notoriously bad cultivators. They do not understand the value of manuring or of tree preservation. Hence "vacancies," often amounting to one-third of the originally planted area, are to be met with, whilst there is in the majority of cases an entire absence of orderly and efficient management, which is responsible for immense loss of revenue annually. These facts are mentioned in order that purchasers may not be disappointed if they find that they have not secured for their money quite a "Kew Garden" pattern of property. As a rule, coconuts are planted 70 to 75 trees to the acre. In Ceylon and Southern India they come into partial bearing at seven to eight years. When ten years old they are in full bearing, and will yield uninterruptedly for seventy years or more.

The average yield of a full-bearing plantation is not more than 45 nuts per tree per year, during which there are six pickings. Statements of yields approaching and exceeding three figures are often to be met with in particulars supplied by vendors, but they should be received with the greatest caution. It is quite true that there are many estates where individual trees will yield 70, 80, 90, and as much as 100 nuts for copra each year, but they are the exception. It is equally true that careful and elaborate manurial experiments have conclusively proved that under scientific and proper cultivation the Ceylon coconut may be made to yield a much higher average than that above recorded. It is in this direction and in the complete utilisation of the valuable associated products of the copra-yielding nuts, that European investors may safely look for very handsome and increasing profits. The test value of the nut for copra is to be found in the count to the "candy." A "candy" is 560 lb weight. Therefore, the lower the count the higher the value of the nuts. Thus the average count in Ceylon is 1,300 nuts to the candy. In Java and the Dutch East Indies it is 1,560, whilst in the Philippines it is over 1,700 nuts. The Ceylon product possesses, in addition to value in the count, an appreciable associate in its fibre, which is always in good demand.

The following will give some idea of the value of the outturn of the Ceylon coconut :—

Count to the candy of 560 lb.	=	1,300 nuts.
Fibre obtained from a candy	=	7 cwt. (mattress) 1½ cwt. (brush)

[Note.—A candy of 1,300 nuts producos 42 gallons of oil, and in "poonac," which is the residue "cake," about 45 per cent of the whole.]

Present value of unhusked nuts on the tree = £4 17s 6d per 1,000.

[Note.—In desiccated form 1,000 nuts yield 330 lb, whilst the parings, which yield high-class copra, average 35 lb weight.]

The present price at Colombo of desiccated nuts is 20 cents per lb., and of nut parings copra Rs. 80 per candy of 560 lb.

A survey of the above figures will enable one to arrive without much trouble at the approximate value of coconut properties.

Take an estate of 1,000 acres, fully bearing, we should have the following returns :—

Acres.	No. of trees.	Annual yield. Nuts.	Gross value of nut harvest. £
1,000	70,000	3,000,000	14,675

The total outgoings will average Rs. 80 per acre, thus showing net profits £8,675, or about £8 12s 3d per acre—not at all a bad return as tropical agriculture goes. Owing to the indifference and want of enterprise among the native owners, the wastage of fibre and other by-products is enormous.

Tons of husks are simply allowed to rot on the ground, whereas if the fine long fibre which they carry were utilised, it would add considerably to the profits of an estate.

Three million nuts give about 750 tons of oil, the ruling price for which f.o.b. at Colombo is at present £31 per ton.

The fibre from 3,000,000 nuts will yield 187½ tons of brush and 750 tons of mattress, the respective prices of which are at present per ton £12 10s and £3 3s. A fibre-making plant capable of dealing with 10,000 husks per day will cost £1,000 sterling.

Here, then, are the main facts connected with the coconut industry as it is run under native management today, but we think sufficient has been stated to show the immense possibilities for development and improvement that are open to the application of European methods, and to the enterprise of the white man.

The opportunities for British investors in tropical agriculture are neither too numerous nor over attractive, but in coconuts—truly termed the Consols of the East—there is just now a clear field, and if, by dallying, they lose these opportunities—and the ubiquitous Contintental capitalist has been much in evidence among coconut lands lately—they will have lost a chance which will never occur again.—*Rubber World*, June 15.

NOTES FROM THE COCONUT DISTRICT, N.W.P.

June 17/24.

LARGE MAY-JUNE COCONUT CROPS.

It seems strange, that in spite of the deficient rainfall, we should have large May-June crops. Everyone of whom I have sought information, has the same pleasant news to give, large crops.

I do not know whether it is general throughout the Island, but the general rule in the Western and North-Western Provinces is, that the largest crops of the year are harvested in May.

June and in July-August. What is the reason for this? It cannot be due to rainfall, for while most rain falls in the Western Province during the S.-W. monsoon, the N.-Western Province, or at least the littoral, gets most rain during the N.-E. monsoon. Shall I hazard a guess? Can it be due to the rain-water of the S.-W. monsoon having more saline matter in it than the rain-water of the N.-E. monsoon? This is an interesting subject for investigation. Will not the Agricultural Society take the matter up and have an analysis made monthly of the rainfall to determine whether during the S.-W. Monsoon months there is more salt in rain-water than during other months?

A. B.

RUBBER IN NEGOMBO.

SOME INTERESTING EXPERIMENTS.

The tapping of the little Para rubber garden, now the property of the Coconut Oil and Desiccating Co., Ltd., planted by Mr. C. M. B. Wilkins in May, 1906, was started some 6 weeks ago, when it was exactly 5 years old. Mr. Wilkins, Managing Director, hopes to secure fully 1 lb. per tree for the first year, which speaks very well for such a very dry climate. The little garden for the first 4 years was never once weeded, the only expenditure under that heading having been the cutting of the fine crops of Mauritius grass grown on the land which is wet and well suited to that product, the garden keeping some 30 head of mill cattle in grass all the year round. As soon as the grass was cut, a liberal top dressing of cattle manure and mill yard sweepings was applied, and the rubber plants well mulched. The roots of the rubber plants were so well protected from the sun that they never seemed to feel the long trying droughts we had with the very poor average rainfall for the district, of only 47" per annum during the 5 years, against the usual 70" to 80" This little experimental garden seems to prove that, under similar conditions, such land in the lowcountry is well suited for a Dairy Farm. At the end of the 4th or 5th year, when, owing to the shade of the rubber trees the grass becomes very thin, one would have to close the Dairy, *i.e.*, the richer milk of the tree will displace that of the cows, which must be consigned to another clearing for their grass supply.

WILD RUBBER.

THE NEW BRAZILIAN DEFENCE IDEA.

That estate rubber is bound to be the controlling power in the rubber world is the intention, and sure knowledge, of all who are concerned in rubber cultivation. Estate rubber will set the price, and the pace. Estate rubber will be produced at a price which, whilst still yielding a substantial return upon capital invested in sound and well managed concerns, will leave no room for antiquated, wasteful, unduly difficult, unstable or expensive operations, such as the collection of wild rubber must ever be. At present fine hard cured Para rules quotations through the whole market, despite the attempts that have been made, and with reason, to list and operate wild rubber and plantation produce separately. This cannot last very much longer. The time is coming when "wild rubber" will be practically beaten out of the market. There is a slight difference between the much vaunted and costly "finest hard cured" and the eastern plantation product. This difference is, however, so slight as to be practically negligible, especially considering the continued improvements in machinery construction on the one hand, and of rubber manufacture on the other. Those who are interested in the sale of the Amazon material, of course, decry the plantation product, declaring that there is no comparison between the two. This is natural. The necessity of their trade compels them to say this, though it resembles much the saying of the thing that is not. The opinion held by persons engaged in industries in which rubber is extensively used is somewhat different. It is probable too that the private opinions of the wild rubber speculators themselves do not quite coincide with their public utterances. However this may be, it is certain that the Brazilian authorities see with fair clearness how the land really lies. Whatever erroneous opinion they may hold as to the comparative superiority of their own rubber over that of the Eastern plantations, they labour under no misapprehension as to the manner in which their position is threatened by the plantations.

It must be said to their credit, also, that, having seen their peril, they are preparing to meet it, and have no intention of being swept off their feet without a struggle. Whether they will succeed or not is quite another matter. The general opinion of those who ponder the problem that faces Brazil, and examine it in all its bearings, is that the wild rubber magnates, and the Government of the Republic will gain comparatively little from all their efforts; that when the Eastern plantations are fully organised, and come into proper working, the wild produce will go down before it as a sand dyke before a flood tide. Several schemes have been proposed for strengthening the position of the Brazilian Government, and protecting Brazilian produce. There have been various valorisation efforts, and market rigging has been carried out on a large and scientific scale. There is also a great scheme for the general improvement of communications, the clearing and dredging of waterways, the provision of more steamers, and the building of many roads. This is the most promising scheme of all. If it does not help wild rubber much it will still open out and improve the country, developing things all round. So far as rubber is concerned, however, the benefit seems highly problematical. In the first place, by the time these roads are built, and the rivers cleared and stocked with shipping, years enough will have elapsed to permit of Eastern rubber estates securing the fullest command of the market, reducing their cost of production, and making it impossible for the wild rubber men to live. The improvements will hardly go far towards cheapening the produce of Para and Amazonas, at least in the beginning. Road building and river training are fairly expensive operations. The work will have to be paid for

by somebody. The rubber regions have no heavy population over whom the cost could be spread in the shape of a light tax. Generally there is no population at all in the regions where the roads will be most necessary. The Government may probably try to recoup itself by imposing further taxation on the rubber. This will ensure swifter ruin, and there is already bitter complaint being made that the taxation has led to much of the present mischief.

Now the various plans and proposals have materialised and taken the shape of three laws, one authorising a £6,000,000 foreign loan and the creation of a bank, which are intended to defend the rubber of Para and Amazonas. The object of the Governments and dealers, as set forth in a message from the Associaçao Commercial of Manaos, to Messrs. Rothschild, London, is to bring about stability of the market. It is remarked, with reason, that if the recent violent oscillations of price continue, Amazonas will be ruined. The Association's telegram says that the measures proposed for the defence of rubber would be intended to ensure normal conditions in the markets only during each crop, following the probable fall of prices long enough for the producer and the trade to regulate business. Calculated on the basis of tho lowest prices, a surtax of 400 reis is sufficient to cover the service of the loan, while there is also to be counted the probable valorisation of the stock employed for the purpose of defence, in order to avoid great and violent oscillations. The capital of the loan will always be represented by the rubber or cash in the proposed banks at Manaos and Para, whose object will be to organise the service and reduce the cost of production of rubber. There is some idea that the loan may be used to buy rubber on a falling market, and some doubt is expressed as to the Government's guaranteeing of the loan, though the bank question seems quite sound, and it may be started in on a £3,000,000 level.

A translation of the most important parts of the laws shows

Art. 1, The Executive is hereby authorised to grant such favours as it may deem necessary, including exemption from taxes, with the exception of export dues, for a period not exceeding 15 years, to such individuals or companies as undertake to establish rubber refineries in this capital or propose by means of new and up-to date methods to wash, rectify rubber in such a manner as to admit of the export of a single type of the first quality.

Art 2. The processes employed for the purification and antiseptic method of preserving the rubber shall not prejudice in any way its chemical and physical constitution as an industrial product.

Art 3. The Executive shall, at the act of granting the concession, determine the conditions on which it is granted, its duration, the rights and obligations of the concessionaires and shall fix the sum to be paid by the said concessionaires for fiscalisation by Government.

Art 4. So soon as the refineries are in full and in regular working order the Executive shall unify the taxes actually levied on rubber exported, in such a way as to eliminate for purposes of tax collection, intermediate and inferior types.

Art 5. Should the yield of the unified taxes on rubber appreciably during the first six months exceed the amount collected during the corresponding six months of the preceding year the Executive shall forward to Congress, at its next meeting, such data as will enable it to decree the reduction of the tax.

Art. 6, All dispositions to the contrary are hereby revoked.

Law No. 1,180 of 17th May:—

Art. 1. The Executive is hereby authorised, in agreement with the Government of the State of Amazons and the Federal Government to contract a loan abroad up to a maximum of £6,000,000 bearing interest at the maximum rate of 5 per cent gold on the responsibility of the two States and with the Federal endorsement.

Art. 2. The duration of the loan shall be 10 years, and the amount realised therefrom shall be devoted to aiding the production of rubber.

Art. 3. To meet the service of the loan, in so far as concerns the State, a surtax of 400 réis per kilo on rubber exported is hereby created, the yield therefrom to be deposited each week in special account in the State Treasury.

Sola Par. The collection of this tax shall cease so soon as its yield produces a sum sufficient for the complete execution of the obligations assumed by the State in relation to the loan.

Art. 4. The Executive is likewise authorised to make an agreement with the Government of the State of Matto Grosso for the purpose of insuring that the surtax referred to in the preceding article shall also be levied on the produce of that State.

Art. 5. The net yield of the loan shall always be represented in cash or rubber.

Art. 6. If it is found impracticable to float a loan in accordance with the terms of Art. 1 of this Law, the Government may contract another up to a maximum of £3,000,000 sterling, bearing interest at the maximum rate of 5 per cent. gold, on the exclusive responsibility of the state and guarantee of the surtax treated of in Art. 3.

Art. 7. The authorisation granted in previous laws for the realisation of any operations of credit for the purpose of aiding and protecting the rubber industry and other products of the State and for the making of such agreements and arrangements as may be necessary, is hereby confirmed.

Art. 8. All dispositions to the contrary are hereby revoked.

Law No. 1,181 of 17th May:—

Art. 1. The Government of the State is hereby authorised, as from the date of this law, to guarantee a maximum annual interest of 6 per cent. gold on the capital of £3,000,000 sterling, issued by series, for a period of 30 years, of a bank to be founded in this City, whose principal operations shall be dealing in agricultural and hypothecary credit, within the dispositions of the present law.

Sola Par. Government may make such preliminary arrangements as may be necessary for the organisation of the bank.

Art. 2 describes the operations of the bank.

TRUE BLUE.

THE HAND OF THE DYER, AND HIS DYES.

Ceylon is not a great dye-producing country. There is, as in every land, a small, localised. manufacture of vegetable and earthy dyes, just as there is a small production of local yarns and textiles. There is, however, no production for export purposes, whilst the small import trade in dye stuffs is limited almost entirely to anilines of the fiercest and most deadly order. Generally, however, Ceylon imports her dyed and printed goods, cotton or silks, from abroad. The gay and often startling *reddhas*, the *veittes* of the Jaffna folk, the *sulus* and *loongies* of the Malay, are designed, woven, and dyed in England, and Germany. The old dyeing industries are dead. In this Ceylon is not by any means singular. Exactly the same state of things is noted in every other country, and not in the East alone. The old vegetable dyes, with their beautiful delicacy of shade, their permanence, are now little used. Their preparation was often tedious and troublesome. They could not be produced as cheaply as the new Western chemical dyes could be bought in the bazaars. The new dyes now shine in the carpets of Persia, and Turkey Central Asia and India, and glow in the gay fabrics with which the world decks itself. They do not glow for long, however, the majority of these aniline and alizarin dyes. Unlike vegetable products they are all fugitive and some are only less so than others. This is known to all who buy the embroidered goods of Kashmir. Beautiful for a spell, they soon go dingy, drab, dirty brown for ever.

Ceylon is not a great dye-producing country, but there is, however, no reason why it should not become one. There was a time when it did not count as a tea-producing territory, and when the rubber brought here experimentally by Wickham was regarded in the light of an interesting botanical curiosity rather than anything really serious. Indeed Ceylon can, if she will, not only produce natural dye of the best, but market it at a price low enough to encourage the dyer to educate himself in the use and nature of true, fast, dyes, and to give his clients honest value for their money, a thing they seldom get now. Ceylon, whilst performing this philanthropic work, can make gains that will content even those accustomed to the wonderful dividends that many of our fine tea-cum-rubber companies have been yielding. She can grow indigo to profit, even as she grows tea, and she ought to do it. She has soils and aspects variable enough, and rainfall and water supplies good enough, on the average, to permit her to do so. She has colonists with the needful brains and energy, and so will be saved from the deadly sins that beset and killed the fndustry in India. She will, as she must, if she is to do any good to herself and to the world, work on modern lines, avoiding blind leaders who would let her fall into the ditch. She can grow good indigo, and produce at once a true blue dye, and immense quantites of the very best manure, just the very kind that is wanted by her light, open, but rather thin soils, manure that has the double advantage of being magnificently rich and healthy, and at the same time cheap. The day comes when the matter will be considered very seriously.

But it will not be enough for Ceylon to grow her indigo, and to put it upon the market in a form that will prove attractive to the dyers. That will be but a portion of her task. If the work is not done completely she will not only be denied her just profits, but will run the risk of suffering losses that need not be suffered. Having produced her dye she must educate the dyers to its use; must force the sales upon the market; must, above all, educate the great cloth buying public. This means that Ceylon must begin by learning all about the matter herself, appreciating it in all its bearings. The public for all that it likes good clothes and prefers to have good value for money, and that may of the feminine half of it make something like a cult of dress, is lamentably, ludicrously, ignorant about dyes. People do not know the alphabet of the matter. As for natural indigo, synthetic indigotine, alizarin or logwood blues, neither dames nor dressmakers know much more than their babes of the differences and characters of these. The dyers know better, and so do some of the dealers, but the hand of the dyer is subdued to the dye in which he works, and he and the dealer give the public what is most easily sold at the largest profit. The public, who would soon be content with margarine, if only it could be sold as butter, buy, and go their ways. They have short memories. Lamenting their faded garments and house furnishings, they content themselves with remarking with a sigh that "there is no such thing as a fast blue." They have reason for this philosophy under present conditions, but they forget the past, and the stuffs that gave warrant for the saying "true blue."

The vast majority of blue cloths, and yarns now on the market are dyed not with a natural indigo but with what must be styled trash. There is no sense in lamenting over the fact, whilst accepting it, or abusing the chemists and dyers, who sell whatever the public will buy. The only way is to make an honest dye and sell it so as to kill out the trash, while educating the public up to it. Ceylon can do this if she enters the indigo trade, as she can and ought. She will do it by carrying on a strong and intelligent campaign on the market and in the press. The matter is easy enough, needing only intelligence, honesty and determination, all qualities to be found in abundance here. Let us glance briefly at the matter, which ought to interest even those who have not any intention of touching indigo, since all may at some time want to buy blue cloth. Into the history of the virtual killing of the Indian indigo industry by the German chemists, who took up and developed the English invention of synthetic dyes we need not enter here. We have already outlined it. Suffice to say that the chemists succeeded in making and marketing a real indigotine, got from tar and other waste. This was a true chemical indigo, containing the identical atoms that went to make the Behar dye. It lacked

something however, an undiscoverable something, possessed by the vegetable product. The result was that it was not fast. It came out in the wash, it faded in the sun, and it shrank from the sea. Also, it destroyed the cloth. It was sold cheaply, however, and in a form that pleased the dyers. The profits were very small though, and have of late almost vanished. Synthetic Indigo is in turn threatened. It has already begun to be displaced, largely by two other blues, firstly by alizarin blue, and secondly by a blue got from logwood. These cheap dyes are, however, even more fugitive and destructive than synthetic indigotine. Alizarin blue in the best cloths fades to a dirty reddish brown if exposed to light and air. It will do this in a month. It also eats absolute holes in the cloth. It begins to go off in a fortnight. Alizarin is fast to sea water only to a certain extent, but it cannot stand the sun. Logwood dyes are even more fugitive, but they do not destroy the fabric. True natural indigo, the old dye, is fast in all conditions, and does not eat the fabric. It is the only blue of which this can be said.

But the public knew nothing of this. They have forgotten about natural indigo, and wait to have the truth regarding other dyes impressed upon them by proof and persuasion. There is an Indigo Association now in existence, but it does no good whatever. It only wastes time and money, and its "work" can only be expressed by the horribly slangy, but expressive, word "footle." It only requires dissolving and remaking. What is wanted is the establishment in London of an emporium and agency with an energetic and able Managing Secretary, a chemist and dyer, one in thorough touch with the trade at the head. This emporium would have branches in the great Northern manufacturing centres, and also in Paris and Berlin. This being done and things kept booming, the public would soon turn from the blue devils of Alizarin and adhere to true blue. It is a great opportunity for Ceylon to do the missionary work,——and take the reward.

JAVA RUBBER INDUSTRY.

Reporting on the trade of Java, Sumatra, &c., for the year 1910, Mr Consul J W Stewart states that the past twelve months were most interesting for rubber in Java, as the oldest of the Hevea plantations had reached the productive stage. Little actual tapping has been done, but some half dozen estates have made a commencement with this work, and the small quantities of 'Java plantation' which have reached the London market have been conspicuous for the high prices realised. Figures as to yields per tree are not yet available, but results obtained have been highly satisfactory, both as regards yield of latex and percentage of dry rubber. On many plantations trouble has been caused by root disease; but planters are taking energetic measures to check it, and the Government chemists are interesting themselves keenly in the matter and rendering the readiest assistance.

Of the capital sunk in rubber ventures during 1910, that of British investors easily takes the first place, and from figures compiled by the Netherlands Indian Agricultural Syndicate it appears that in Java alone no less than £5,500,000 has already been paid up in respect of 87 British companies with an authorised capital of nearly £7,000,000. The figures are admittedly incomplete, as the origin of all the capital is difficult to trace, and it is probable that the actual British interest is even greater. The agricultural syndicate mentioned above has also endeavoured to collect statistics as to the area planted with rubber in Java, and have arrived at a total of 157 estates, with an area of 85,000 acres of planted rubber, principally Hevea Brasiliensis. These figures are, however, recognised as incomplete, and owing to the apparent reluctance of many planters to furnish it will probably be some years before reliable statistics can be obtained.

An interesting feature in connection with the rubber industry has been the establishment in Java during 1910 of a British firm of rubber engineers who are constructing large numbers of temporary and permanent rubber factories. An inferior variety of wild rubber, the export of which has of late years attained considerable proportions, is that known as jelutong. This product is collected by natives in the forests of Sumatra and Borneo and is obtained from trees belonging to the Dyera and Alstonia families. As the method of collection employed by the natives is extremely destructive to the trees the Government of Netherlands India has found it necessary, in order to prevent their extermination, to impose restrictions on the collection of jelutong. Concessions for the exclusive right of collection have already been granted to two companies, one American and the other German, and there are still large stretches of territory available. —*H. & C. Mail*, June 16.

EUROPEAN SUPERVISION IN THE MIDDLE EAST.

This is a subject which is engaging the thoughts of experienced Planters in this country. It has been asserted that there is already too much recruiting of white men from Europe. In the opinion of more than one leading Planter whom we have interviewed the opposite is really the case. We want much more white supervision, said one Selangor Planter, and the estate which stints itself in respect of the same is adopting a suicidal policy. Lack of European supervision was bad enough in the earlier days. With the prospects of a number of estates approaching the bearing state it is rendered a much more serious matter, and there must be no weakening but rather strengthening of the European staffs on the different estates in this country. The extra initial expense to an estate, caused by the addition of one or two European Assistants, will be more than compensated by the results due to supervision. The question of European supervision is one of the most important of the hour, and we hope that some of our readers, who realize its importance, will give their views for the benefit of their brother planters. We hope as time goes on to interview leading Planters on the subject, which, as we have pointed out is one of deep concern to the welfare of this country. Mr W R G Hickey, manager of Shelford estate, Klang, advocates much closer supervision by Europeans than can now be observed. (Grenier's.)—*S. F. Press*, June 20.

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THE BRAZILIAN COCO-PALM.

Pernambuco is situated in the centre of tho tropical part of Brazil, within which the coco-palm grows most luxuriantly. The coco-palm seems to be indigenous to the district* which extends from the vicinity of Bahia on the south to Parahyba on the north, but it attains its fully luxuriant and most prolific development in the vicinity of Pernambuco. The coco-palm is one of the most beautiful and attractive natural adornments of many of the public parks and private gardens of Pernambuco, often attaining a height of from eighty to ninety feet. The trunk is without branches, and the leaves which cluster in a tuft at the top are from fifteen to twenty feet in length. At the base of tho leaves the nuts hang in clusters, the number varying from three to fifteen according to the age and condition of the tree. The United States Consul at Pernambuco says that the nut is first planted in its natural state with hull and fibre. At the expiration of about twelve months, or when the plant has reached a height of about three feet, it is transplanted and set out in rows about forty feet apart. If cultivated and irrigated the tree will produce at the end of five years, otherwise it will require about ten years to produce. Although the rainfall within the coast region averages about eighty inches per annum, it all occurs during the months of the rainy season, and often when it is of no service to certain vegetation. The summers are hot and dry, and young plants and trees need to be irrigated. There are two coconut markets in the city of Pernambuco, one for the green and the other for the mature or dried nuts. The green nuts, which are picked at about the end of five months, and before the real meat of the nut has begun to form inside, are composed entirely of water, which forms one of the principal and most popular beverages of the neighbourhood. The water is non-alcoholic, and when iced is converted into a most savoury refrigerant. Its action is diuretic. When the nut is partially mature the inside is sometimes extracted, and by the use of sugar and some other ingredients is converted into a popular confection. The meat of the dried or ripe nut is used exclusively for food, being usually seasoned and mixed with different provisions for flavouring purposes. The owner of one of the large plantations in Pernambuco has recently stated that he averaged about four shillings net profit per annum from each tree. The greater proportion of the nuts are consumed locally, but a considerable quantity is shipped to Rio de Janeiro and other cities of Brazil, and also to European countries where the improved facilities for extracting the oil have greatly enhanced their value.—*Royal Society of Arts Journal*, June 16.

*Not so we think and DC Candolle is our authority—this palm has its habitat in the Eastern Archipelago, about Sumatra.—ED., *C.O.*

W. J. & H. THOMPSON'S ANNUAL REPORT ON THE TEA TRADE.

38, Mincing Lane, June, 1911.

The publication of the official statistics for the twelve months ending May 31st affords an opportunity of reviewing the history of the past season, recording its results, and of surveying the position and outlook. The period under review has provod a successful one for producers in the aggregate, although those who make common and medium tea have increased their profits to a greater extent than others. Tho most important factor has been the increased consumption in countries other than the United Kingdom ; notably in Russia, where the greater purchasing power consequent upon prolific harvests has resulted in an increased demand for tea. The amount of British grown tea taken outside the United Kingdom during the past 12 months exceeded last year's by 16 million lb. The majority of this increase was purchased locally, with a result that from India, despite an increase of about 6½ million lb. in the total shipments, receipts in London have been smaller by over 8 million lb. From Ceylon the increased offtake amounted to over 4¼ million lb., coincidently with very little alteration in the quantity of China tea purchased. The result here was felt in smaller imports, which, coupled with a continuance of a good rate of Home Consumption, conduced to the buoyant and rising market experienced from autumn onwards, culminating in the early months of 1911 in a higher level of value for common and low medium teas than has been reached during recent years.

In our last Annual Review we stated that, assuming a continuance of the increased consumption both at Home and Abroad, and in the absence of any sign that China tea was regaining favour, the question to be considered was whether there would be sufficient tea from India and Ceylon to supply requirements. This belief has been fully justified, and although Home Cousumption has been little more than stationary for over a year—the increased quantity used being only equal to the estimated rate of growth of our population—the large increase taken by other markets, Russia and Australasia in particular, has created a shortage here, from which the healthy state of the London market has been the direct outcome. An examination of the movements during the year reveals the reason for the present basis of values. Common and low medium grades have not been offered in unduly large quantity here, as the Dooars and Assam have furnished a smaller amount than usual of tea coming under this category. As these grades are used by all the great distributors in their blends—the efforts on the part of those interested to induce the public to use finer tea having had as yet very little success—demand increases to an extent that affects quotations, keeping the price of fair Pekoe Souchong between 7½d and 8d per lb. As is always the case when the attention of the trade is concentrated on the lower priced varieties, better class teas receive less support, and it is to be regretted that, during the past year, good and fine grades, particularly those from India, have hardly been appreciated to the extent of their worth, although choice tea has not failed to find a ready sale.

Indian Tea.

The crop despatched from India has again created a record by exceeding that of last season by about 6½ million lb. At the beginning of the season weather conditions were favourable, but afterward, heavy rainfall experienced in many localities made later flushes rather indifferent in quality. In Assam, the early flushes were the best and a number of good teas were received, but the autumnal crop again proved disappointing, and only a few flavoury invoices were marketed. Cachar and Sylhet, which in 1909-10 sent a large crop of good useful tea, fell away slightly, both as regards output and make of leaf. Continental enquiry has been consistently good for leaf teas from these districts, as well as for suitable teas from the Dooars, which has furnished a larger quantity of tea fully equal, if not preferable, on the whole, to that made last season. Autumnal teas from this district possessed good colour and flavour, and fully deserved the high prices paid for them. The Terai has been more fortunate this season, and while climatic conditions have been somewhat adverse, the yield, both in quantity and quality, has shown an advance on the previous one. In Darjeeling more tea than in 1909-10 was made, but in character the majority of invoices were inferior. Nevertheless, the expanding demand for this growth, for home and Russian use, has ensured high prices for all with distinctive flavour. Following the shortage in Ceylons the attention of the trade here has been diverted to Southern Indian varieties to make up the deficiency, with the result that the increase from Travancore and the neighbouring districts has boen well received, and with quality on the whole excellent, remunerative prices have willingly been paid. The average of public sales in London on growers' account is about 8 3-5d against 8 1-3d the previous season, and 7 7-8d in 1908-9.

Ceylon.

In contrast to the record crop in 1909 of nearly 192 million lb, the output from the Island, during 1910, showed a deficit of over 10 million lb, viz., 181½ million lb. To what extent this heavy falling off is to be attributed to the effect of interplanted Rubber is difficult to determine, but as in many gardens where no Rubber is grown there has been a shortage in output, it is safe to put adverse climatic conditions, as the principal cause. The quality of the teas received here has been up to the average, the proportion of commonest grades being smaller than usual. Of the entire crop gathered, 108 million lb, or 60 per cent, was marketed in London, and realised an average price of 8·20d per lb as compared with 8·15d per lb in 1909-10, and 7·86d in 1908-9. The appreciation of and demand for Ceylon tea, as a distinct variety, continue to be shown in all quarters.

China.

The quantity of China tea used here has shown some expansion, owing to the high prices ruling for common teas from India and Ceylon.

A larger amount has lately been taken by the trade for blending purposes, and the percentage used since January 1st has risen to 6 per cent or more of all the tea used in the United Kingdom, compared with about 3½ per cent in 1910. The quality of the teas received here has not been remarkable. A number, smaller than usual, of choice teas arriving early in the season were readily absorbed. During March the better grades were largely purchased by Russia, from whence a somewhat unusual demand was experienced; but a quantity of very common tea has been obtained from America to supply the wants of those who retail tea at a low quotation. This is entered amongst imports and deliveries of tea "From other countries."

About the middle of March a cable was circulated through the Press, to the effect that it was the intention of the Chinese Government to prohibit the importation of all foreign tea into that country, and to reduce the export duties on China tea, amounting to about 2d. per lb. A prompt protest was made by the Russian Ambassador at Pekin, and while the former proposition would have a temporary disturbing effect in Calcutta and Colombo, the movement is primarily directed against the Russian-owned Brick-tea factories situated at Hankow. A large quantity of Indian and Ceylon dusts and fannings, bought locally, is used there to face the brick tea. This trade has during the past few years assumed large proportions, some 12 million lbs. having been taken direct from Calcutta and Colombo for this purpose. The action of the Chinese Government, if persisted in, may have the effect of making the Russians remove the factories out of Chinese territory. The second proposition is clearly designed to promote the export of their own tea, thus enabling them to compete on better terms with other tea-producing countries.

Java.

Java teas have not shown the expansion in output which was generally expected, and the total quantity marketed here has only exceeded that of last year by ¾ million lb. While unfavourable climatic conditions have to a certain extent accounted for this, it must be remembered that the acreage under cultivation can only increase slowly, for, although most of the estates own undeveloped land, the labour supply, although generally readily obtainable and cheap, yet owing to the prosperity of the natives, is not everywhere abundant, and many proprietors who also have rubber plantations hesitate to increase the area under tea in face of the difficulty of maintaining an efficient labour force for both crops. The produce has been, speaking generally, excellent; and the attention given to market requirements, both as regards manufacture and packing, is not surpassed anywhere. A feature of Javanese teas has been the consistent equality of the offerings, which ensures for them a continuance of support throughout the whole year. The majority of the estates have for some years used the finest Assam seed, and with expert cultivation and manufacture are now producing tea which ranks with that from good Indian and Ceylon estates. During the past twelve months the crop gathered has been about 40,500,000 lb. of which about 32 per cent has been disposed of on the London market. Asia and Australia—not London nor Holland—secured the additional 4 millions exported in 1910.

The scramble for tea during the early months of the present year has drawn attention to other possible sources of future supply, and from countries not previously known as tea-producing, come rumours of planting and cultivation. We hear of operations in the highlands of British East Africa, and already a small quantity has been marketed here. In Annam there are plantations which are now in process of being equipped with the latest machinery, where experimental use of Assam seed gives promise of improved quality and quantity by degrees from this little known territory. Natal's small crop continues to be locally used. The labour question is yearly becoming one of the most important problems to be faced in all producing countries, and with the competition created by the requirements of rubber plantations, considerable expansion in the area under tea is made difficult. How this can be overcome is a matter of particular importance, for at the present rate of development in the total consumption, progressive, not stationary, production is needed.

With the present outlook for tea, small stocks, and supply and demand gradually becoming more nearly adjusted, the question arises in many minds as to the probable policy that will be adopted in the manufacture of the coming crop. That the values of low priced teas seem likely to remain on a higher basis than has been the case the past few years seems patent to most observers, and consequently the temptation to pluck "freely," even on gardens where such has not been the case, is not unnaturally strong, but under this head we would remind our friends that coarse plucking may easily lead to such deterioration in quality and such increase in quantity, that the net result would not improbably prove less satisfactory than some anticipate. Quality, though not apparently realising its proper comparative value, is wanted, and more perhaps now than previously, as the Blenders, although tied to price, must give their customers a good palatable drink for the money.

The disturbing influence of the Budget announcement has again caused some dislocation of business, and while the effect on deliveries has not been great, the uneasiness caused throughout the country by the uncertainty both as to the probable date of the Chancellor's statement and the possibility of any alteration in the Duty has been very marked.

The growing interest taken by the public in tea has been shown by a business done in tea shares greater than for many years past, with the result that not only have the public a more marketable security, but in addition have, under the favourable condition of the Industry, seen a marked appreciation in the value of their holdings.

		1910-11.	1909-10.	1908-9.	1907-8.
Stock May 31st all kinds	lb.	87507000	91058000	69531000	95404000

In the season 1908-9 deliveries were swollen and Stocks were depleted by abnormally heavy clearances prior to the Budget.

TOTAL TRANSHIPMENTS DURING THE PAST FOUR SEASONS—1ST JUNE TO 31ST MAY.

		1910-11.	1909-10.	1908-9.	1907-8.
Indian	lb.	10231700	8643700	9192900	8866300
Ceylon	do	3229600	3506500	2365900	2894800
China	do	1705600	1631900	3440400	2329400
Java & other Countries	do	1629700	1684900	1283400	1108100
Total	do	16799600	15467000	16.82600	15198600

Average price realised for Indian Tea sold in London on Garden Account	1910 —8 3-5d 1911	1909 —8 1-3d 1910	1908 —7 7-8d 1909	1907 —8¼d per lb 1908
Average price realised for Ceylon Tea sold in London on Garden Account	1910 —8 1-8d	1909 —8 1-8d	1908 —7 7-8d	1907 —8d per lb

TEA SHARES.

COMPANIES' RESULTS FOR THE PAST YEAR.

Sufficient of the tea companies have issued their reports for the 1910 season to make it possible to analyse their results and to see how far great expectations of last year are in the way of being realized. It will be remembered that directly after the rubber boom had exhausted itself in the spring of last year there was talk of a coming tea boom.

The arguments in favour of a boom in tea shares were based on three factors. First, the world's consumption of tea was showing a steady increase, for which the Indian teas were wholly responsible; even in those countries where China tea was still consumed in large quantities its use was steadily diminishing before the ever-growing taste for a stronger-flavoured leaf. The second point was the belief that before the production of tea could rise to meet the increased demand a substantial advance in price would have to take place, this belief being based on the argument that most of the land suitable for tea cultivation was already planted. And the third factor rested on the assumption that the boom in rubber would lead a large number of tea companies either to abandon tea or so to interplant with rubber as seriously to diminish the productive capacity of their land.

In the following table are shown the total crops and the net profits of the Companies for 1909 and 1910:—

Company.	Crop. 1909. lb.	Crop. 1910. lb.	Net Profit. 1909. £.	Net Profit. 1910 £.
Alliance	1289700	1186600	*a*12051	*a*102 7
Amalgamated	4312000	4355300	*a*39251	*a*55751
Bandarapola	80500	733600	*a*7920	*a* 4336
Ceylon Tea Plant.	5516500	5400000	*a*71112	*a*76546
Ceylon Prop. Tea	1229900	1179800	8456	*a*9836
Consolidated Tea and Lands	16391500	16462200	148460	*a*179326
Eastern Produce	4807400	4782100	*a*66162	*a*75133
East India and Ceylon	2012900	2059900	—	20209
Imperial Tea	5267300	5335000	41718	47877
Lunuva (Ceylon)	1739100	1758900	12813	*a*13134
Nuwara Eliya	1824700	1686100	20885	21336
Standard Tea	1305800	1278500	14831	15080
Yatiyantota	1505700	1414100	12583	*a*18186

*a*Including profit from other sources.

CROPS SMALLER AND PRICES HIGHER.

It will be seen that in practically every case crops were smaller, but it must be remembered that 1909 was an exceptional year, some of the estates then securing the biggest crops on record, and therefore a certain falling off was to be expected. The falling off in crops was due to much less favourable climatic conditions, but as so often happens with most natural products, a shortage in supply produces its own compensation in higher prices. Net profits, it is safe to say, would have been larger but for the difficulty in obtaining sufficient native labour in Ceylon, due in a great part to the extension of rubber planting in that island. On the last occasion when tea prices rose considerably many of the Indian estates adopted the practice of what is known as "coarse plucking" in order to take advantage of the high prices ruling, "Coarse plucking" means the utilisation of the lower leaves of the tea plant, and these are naturally inferior in quality. There is, however, no indication from the results so far published that any tendency in this direction was allowed to develop last year. This point, perhaps, is more clearly brought out in our next table:—

Company.	Average price per lb. 1909. d.	Average price per lb. 1910. d.	Yield per acre. 1909. lb.	Yield per acre. 1910. lb.
Alliance	8·05	8·09	479	442
Amalgamated	9·31	9·15	336	388
Bandarapola	5 86	6·22	713	642
Ceylon Tea Plantations	8 33	8·44	523	496
Ceylon Proprietary Tea	7·55	7·94	463	462
Consolidated Tea and Lands	7·66	7·84	553	551
Eastern Produce	7·90	8·05	440	437
East Indian and Ceylon	7·36	7·62	—	—
Imperial Tea	7·70	7·81	490	493
Luuuva (Ceylon)	6·68	6·70	512	492
Nuwara Eliya	8·05	8·36	640	592
Standard Tea	7·96	8·12	517	503
Yatiyantota	6 03	6 23	534	503

QUALITY PRACTICALLY MAINTAINED.

Here are shown the average price per pound realised on the whole output in 1909 and 1910 and the yield per acre for each of the two years. Prices in every case are higher and yields generally lower. Where yields have fallen substantially it is nearly always the case that the price has risen proportionately, indicating that there could have been little falling off in quality as compared with the general average. The decline in the yield per acre shows, however, that the falling off in the total production of tea is not due to any restriction of the area under cultivation, nor is the falling off in the yield per acre sufficient, except in a few isolated cases, which in themselves may have been the result of a particularly bad season, to have been due to the interplanting of rubber.

Therefore, on the results of the past year there seems little to justify the expectation of a real boom in tea shares; in fact, as rubber and tea thrive on similar soils, the extension of rubber planting has resulted in a rise in the price of labour, and this, as far as can be seen, is not likely to fall while tea and rubber are not less profitable than at present. As regards the immediate future, however, while trade continues so active all over the world, the consumption of tea will go on increasing, for the consumption, as may be seen from a glance at

the figures of the past few years, always expands with any increase in the purchasing power of the working classes. Production on the other hand is limited hy the margin of solling prices over cost, Thus thore is a likelihood of an increase in toa prices, but it seems equally prohahle that the increase in cost of cultivation will not allow of a larger margin of profit. The statements regarding the smallness of the available area of uncultivated tea lands in Ceylon and India have heen refuted by reliahle authority and it therefore seems extremely douhtful if any restriction of the potential production may be anticipated through the limitation of the area in tea. In conclusion a tahle may be given showing the capital and movement which has taken place since last year in the shares of the leading tea companies, including those whose results we have discussed where possihle.

Company,	Shares. £	Paid. £	Dividends. 1909.	1910.	Price end of May. 1910.	1911.
Alliance	1	1	10	10	*a*16	12 1-18
Amalgamated	10	10	nil	nil	—	$7\frac{1}{4}$
do Pref.	10	10	(paid to May, 1908)		$9\frac{1}{4}$	$9\frac{3}{4}$
Ceylon Tea Plantations	1	1	30	35	$7\frac{1}{2}$	$7\frac{1}{4}$
Cosolidated Tea and Lands	10	10	nil	nil	10	14*b*
Consolidated $7\frac{1}{2}$ per cent 2nd Pref.	10	10	(paid to Nov., 1907)		13	$11\frac{1}{4}$*b*
Eastern Produce	1	1	14	20	$16\frac{3}{4}$	3 1-8
East India & Ceylon	6	6	10	$12\frac{1}{2}$	9 7-8	$11\frac{3}{4}$
Imperial Tea	1	1	7	$7\frac{1}{2}$	*a*$8\frac{1}{4}$	1 1-16
Nuwara Eliya	10	10	8	8	$13\frac{1}{4}$	13
Standard	10	10	20	20	$27\frac{1}{2}$	$27\frac{1}{2}$
Yatiyantota	1	1	8	15	*a*$26\frac{1}{2}$	2 7-16

a £10 shares. *b* Ex. div.

—*Financial Times*, June 15

TREES AND MOISTURE.

A GREAT EXPERIMENT.

In order to determine the actual effect of forests on the flow of the great waterways of the country, one of the most important and far-reaching experiments ever undertaken is being carried on in the United States. Experiments are being made on the crest of the Rocky Mountains at the head-waters of the Rio Grande in Colorado to settle beyond all further question the effect of trees in conserving moisture.

Minute observations (says the *Philadelphia Record*) will he made, winter and summer, until the average conditions in the heavily forested area at the Rio Grande headwaters are established beyond doubt. Then that portion of the watershed will he denuded of all timher, and not less minute ohsorvations will be taken of the conditions that obtain after the trees have been removed.

The experiments will no douht extond over an indefinite number of years. Those who have undertaken the work will not stop until they consider that there is nothing more to be ascertained on the suhject. The Government has estahlished an experiment station at Wagon Wheel Gap, well toward the headwaters of the Rio Grande. Both watersheds are being covered and the flow of the streams toward the Atlantic and Pacific are noted. The area included in the experiment ranges from a trifle over 9,000 feet to nearly 11,500 feet in altitude, and is situated in the Rio Grande National Forest.

This site was selected after all the Colorado National Forests on the Continental Divide had heen thoroughly examined and comparisons had heen made. Dams and weirs have heen put in and the water is being accurately measured under all conditions, winter and summer. Each watershed carries a small stream of a permanent character, common to the upper slopes of the Rocky Mountains. The streams will he measured until a distinct relation hetween them has been estahlished.

By a large numher of meteorological observations for a number of seasons, it will he possible to average the general conditions and establish the regimen of such streams. The Government Weather Bureau is co-operating with the forestry service in the ohservation of conditions at Wagon Wheel Gap.

Difficulties of the Work.

A continuous automatic record of rainfall is kept at various points on both watersheds. The amount of snow falling upon different parts of the area included in the experiment must he recorded faithfully, and accounted for hy melting or evaporation.

The air tomperatures, which affect the melting of the snow and ice and cause evaporation from the soil and from the surface of streams, must bo continuously and accurately recorded and the humidity of the air ohtained at the same time. The temperature of the soil on the slopes must be taken affecting as it does the melting of snowbanks in the spring. In short, every day of every year must he classified as regardst he factors which might affect stream flow.

No matter how severe the weather, the Government force of experts is out at Wagon Wheel Gap, measuring streams, making notes on snow falls and temperature, and contributing a new chapter to the interesting story which is being unrolled by science. The streams at this altitude are icy cold even in midsummer, but in winter their temperature is nearly unhearahle. Nevertheless the water observers have to don their wading hoots and stand in the middle of each rushing stream, with delicately adjusted recording instruments at their ears, until they have measured the velocity of the water.

Then careful measurement of the height of the stream must be taken the observer still standing almost hip-deep in the icy stream. In severe storms the difficulties attending the measurement of snowfall are sometimes great. Often it is necessary for the experts to visit the snow stations on snow-shoes, and similar difficulty is encountered in visiting the meteorological stations where weather conditions are recorded.

Construction of Storm Weirs.

One of the most interesting features of the work is the operation of the weir method of control by which the stream regimen is secured. The instrument is a stage register actuated by a float, within a still well which is located in the centre of a hasin ahove the weir. The instrument gives a continuous graphic record of the water height hy the revolution of a drum which is actuated hy a float, and by the movement of a pen, actuated hy clockwork, across the record sheet. The weirs are so coustructed that they may be easily regulated for all stages of water

A storm weir has been installed at each dam to care for high floods. To prevent the loss of water through underground seepage concrete dykes have been put in, which catch all the sub-flow. These dykes open into a settling basin for the purpose of setting the water and catching the debris carried on the stream at flood time. This will give an accurate idea of the silt carried by each stream in flood time. The deposit of silt in the settling basin is measured from day to day, thus giving a correct idea of the amount of foreign material carried by such streams under all conditions.

The rainfall is measured at the foot of each watershed, and at a common point near the heads of the two sheds, making three automatic measurements. Besides the automatic registering rain gauges there are two ordinary 8 in. gauges on each watershed. For measuring the snow, 16 snow scales have been installed. The depth at each is measured after each snowfall and the water equivalent to the snow on the ground is obtained by taking representative samples. Soil temperatures which are highly important are taken to depth of six inches and are obtained by electric resistance thermometers which are read each day.—*Literary Digest.*

INDIAN AGRICULTURE.

It is estimated that nearly 86 per cent. of the inhabitants of India gain their living in agricultural pursuits. Yet it is a fact that agriculture in itself is not deemed an honourable calling. Students have traced this strange belief to the Buddhistic times when it was conceived to be the gravest sin to take the life of the minutest of living things, and naturally those who dug and turned the soil, crushing worms and ants and the like, were looked upon as sinners. But the contempt for the tiller of the soil goes even further back, for when Manu created the four great class divisions amongst the Hindus, he placed Sudras, the agriculturists, as amongst the lowest. At the present time the agriculturist is not necessarily a Sudra. Brahmins and Rajputs will put their hands to the plough, and we believe, it is only certain classes amongst the Jains who carry their religion so far that they will not dig the soil for fear of crushing some minute insect. At the same time the distaste for agriculture still remains, and if such great multitudes are engaged in it, it is because they have nothing else to which they can turn their hands and because of their general apathy and belief in Fate. There is no sign that the business of agriculture is likely to be taken out of the hands of the very ignorant people who are engaged in it. And as it is only the very ignorant who in the whole history of India have ever tilled soil, it is not surprising that this fertile country should in the broad result be yielding in food stuff both as regards quantity and quality, much less than other parts of the world not so blessed by Nature but occupied by a progressive and intelligent race of farmers. It may be said, of course, that nothing is to be expected from the rayat. He is in debt and so many zemindars' agents have so many ways of robbing him of anything beyond what is sufficient to keep him alive, that it is not to his interest to grow better and larger crops than he is obliged to. That is, of course, true, but the point is that if zemindars, who, particularly in Bengal, are well educated men with interests not entirely selfish, could be induced to take in agriculture the same interest that rich landed proprietors do in other parts of the world a great impetus would be given to the scientific utilisation of the soil. A few zemindars in Bengal maintain what are styled home farms, and it is with these that a beginning might be made. It is not even necessary to spend money on experiments. The Government has done that and continues to do it, but the results of the official experiments are not taken advantage of, and, apart from the help given to European planters, the money spent on the official experimental farms has not produced an adequate return.—*Times of India*, July 7.

TEA AND COFFEE IN CHILE.

The quantities of tea, coffee, and yerba mate consumed in Chile are shown in the following table, writes Consul Alfred A. Winslow, Valparaiso:

Year		Tea	Coffee	Yerba mate
1906	...	2,845,546	6,969,259	8,944,408
1907	...	2,329,239	5,938,592	8,925,444
1908	...	2,289,382	5,773,493	5,377,955
1909	...	2,752,279	8,541,863	7,788,242
1910	...	3,343,789	9 25 ',736	9,287,806

Either tea or yerba mate is served in Chile at 4 p.m., not only in the homes, but at clubs, restaurants and hotels and many business houses. A cup of tea and a roll or small cake in the club or hotel cost from 8 to 12 cents United States gold, while the business houses serve it free rather than have the clerks leave their work to go out for it.

Ecuador supplies about 50 per cent. of the coffee, Brazil 21 per cent., Guatemala 6 per cent. and the balance scattering. Brazil supplies 45 per cent. of the yerba mate, and Uruguay about 37 per cent. England supplies 89 per cent. of the tea and Germany 8 per cent. The duty on coffee is $1·66 United States gold per 100 pounds; on yerba mate, 83 cents per 100 pounds; and on tea, $16 59.—*American Grocer.*

CEARA RUBBER INVESTIGATION.

The latest *Bulletin of the Imperial Institute* gives a variety of interesting information as to the recent investigation made by the scientific and technical department of the Institute. A considerable number of samples of Ceara rubber have been forwarded to the Institute from British Colonies and Protectorates. Referring to Ceara rubber from Ceylon, it is stated the specimen weighed 10 oz., and consisted of three square sheets of light-brown opaque rubber, clean and well prepared, but a little mouldy on the surface. The physical properties of the rubber were very satisfactory. A chemical examination gave the following results:—Moisture, 0·9 per cent ; caoutchouc, 91·3 per cent ; resin, 3·1 per cent ; proteid, 3·4 per cent; ash, 1·3 per cent. The specimen was valued at probably about 8s. per lb. in London, with hard Para at 10s. per lb., and good to fine plantation Para biscuits at 8s. 10½d. to 9s. per lb. This rubber is of good quality and satisfactory in composition, except that the amount of ash is unusually high.

AN INTERNATIONAL RUBBER EXHIBITION.

FIRST NOTICE.

The International Rubber and Allied Trades Exhibition now open at the Royal Agricultural Hall represents the increased knowledge of every phase of the industry gained since 1908. All phases of the industry and allied trades are represented in the exhibits and the Government of most of the rubber-producing countries are represented. Among the British States and territories represented are Queensland, Ceylon, the Straits Settlements, the Malay States, the Gold Coast, British East Africa, Uganda, British Guiana, Trinidad and Dominica. Stands have also been taken on behalf of Southern India and British North Borneo The foreign Governments represented include Belgium and the Congo, Holland and the Dutch Indies, the German Colonies, Madagascar, the French Congo, the States of Para and Manaos, Brazil, Peru, Hawaiian Islands, Indo China, and French Equatorial Africa.

The Ceylon and Malaya stands provide the visitor with a very excellent idea of the progress which the plantation industry has made in these portion of the Middle East. Several plantation companies are giving their shareholders the oppoitunity of inspecting the produce from the plantation.

Amongst these exhibits the Guthrie ground represented by the products of the following companies :—

Linggi Plantations, Limited.

Kabu (F.M.S.) Rubber Company. Limitod.

Kamuning (Perak) Rubber and Tin Company, Limited.

Galang Besar Rubber Plantations, Limited.

Sungei Buaya (Sumatara) Rubber Company, Limited.

Other individual companies whose products are being shown are:

Highlands and Lowlands Para Rubber Company, Limited, one of the market leaders ; the Mabira Forest (Uganda) Rubber Company, Limited ; the Singapore Para Rubber Estates, Limited, another dividend-paying concern in the Malay States ; the Unitod Malaysian Rubber Company, Limited; the Soconusco Rubber Plantations, Limited, in the State of Chiapas, Mexico ; and the Rosehaugh Tea and Rubber Company, Limited, of Ceylon.

All the principal estates in Ceylon are represented by exhibits of plantation rubber and photographs. The arrangements are in the hands of two committees, one appointed in Ceylon and the other in London, Mr. Edward Rosling represents the island as Commissioner, Mr. Kelway Bamber and Messrs. A L Baines, F H Layard, H Storey, G H Golledge, and F Crosbie Roles are the delegates appointed in Ceylon, while tho following gentlemen from the London Committee, representing the Ceylon Committee in conjunction with the above at the Exhibition, viz.: Messrs C J Scott, A Bethune, R A Cameron, G F Traill, W Martin Leake, C S Armstrong, Percy Bois, H K Rutherford and G F Walker.

July 4 will be a Ceylon day and no doubt planters from the island who are now at home will be specially attracted. In the Dutch Court may be seen what the plantations of Java and Borneo are doing with the co-operation of British capital in developing the rubber plantation enterprise. The number of specially-designed machines with which an efficient rubber factory must be equipped form a most important and instructive feature of the exhibition. The papers read and discussed during the conferences will be of great value, for they embrace such subjects as vulcanisation processes, the constituent parts of the parent Guayule, crude indiarubber, tapping Hevea trees, indiarubber shrubs of Africa, their cultivation and working, dissolving indiarubber, physical and mechanical tests of indiarubber, hygienic conditions, and maintenance of health in the rubber planting districts of the tropics, etc. At this, the biggest rubber exhibition yet held, everyone connected with the industry may see under one roof a complete exposition of the many and varied phases of the rubber enterprise.

A private press view of the Exhibition took place on Saturday, and was followed by a luncheon, over which Major Sanderson presided, in the absence of Sir Henry A. Blake, G.C.M.G. (the president), who had been commanded by the King to attend the Naval Review at Spithead. It was announced that the following telegram had been forwarded to His Majesty: "Sir Henry A. Blake (the president) and management of the International Rubber and Allied Trades Exhibition (of which Your Majesty is patron), the scientists, chemists, and manufacturers coming from all parts of Your Majesty's Dominions, and the representatives of the numerous foreign Governments, who are officially taking part in the Exhibition, and who are assembled at a press view at the Royal Agricultural Hall today, send loyal and dutiful greetings. We most earnestly pray that you and your Royal Consort may live long and have a prosperous reign. Should Your Majesty find time to visit the Exhibition it would give unbounded satisfaction." (Cheers.)

The opening ceremony of the Exhibition was performed by the Earl of Selborne on Monday.

Sir Henry A Blake, president of the Exhibition, in introducing his lordship, said that there were represented at the Exhibition delegates and official representatives from every rubber-growing country in the world. They had come together in friendly international competition for the purpose of shewing the progress that had been made in that great industry since the last exhibition in 1908, and also for the discussion of papers that would be read dealing with future problems. The Exhibition showed the great advance that had been made in the industry, the extent of which was very roughly appreciated by the public, and yet a very small fringe of the industry had been touched.

Dealing with the production of rubber, Sir Henry Blake said that last year the yield was 75,000 tons, which, at 7s. a pound, was valued at £85.000,000. Putting aside the wild rubber from Brazil, all the plantation rubber that had yet come to the market was but a very small

amount in comparison with the amount of rubber that would be put on the market within the next two or three years. Some people had assumed that the price of rubber must come down considerably in consequence of the increased production. He earnestly hoped it would, because, it was a mistake to imagine that the price of rubber must necessarily interfere with the return on capital and the amount which up to the present day had been won from the immature trees would be enormously increased in the near future and the increased yield of the mature trees would more than compensate for the decrease in price. That would bring the rubber industry into an entirely different horizon Manufacturers were only waiting for rubber at a reasonable price to enable them to look forward to limitless expansion of the uses of rubber. When that time came rubber would be a product of the world as wheat.

The speaker referred to the specimens of rubber pavement which are laid down in various parts of the hall, and said that he had no doubt that the time would soon arrive when the process would be absolutely perfect for the purpose of street paving, and when the time did come a diminution of the nerve strain and brain fag by the cessation of street noises of the present day would bring improved health and comfort to the busy workers of the great cities.

The Earl of Selborne, who has received with cheers, referred to the representative character of the Exhibition, and its completeness and authority. What great contribution, he said, rubber had given—and it would be much more so in the future—to the solution of the problems of prosperity of some of those parts of the Empire whose administrative lot had been a struggle, in its financial character for a good many years past. The effect of the rubber industry upon the West Indies and different parts of Africa, not to mention the East, would be enormous. In the production of rubber there lay the secret of prosperity and financial stability hitherto unknown in the tropical and subtropical parts of the Empire.

Apparently this was the first time in which the tree products of a tropical zone were likely to rival, in adaptation for the purposes of art and manufacture, the tree products of the temperate zone. It was curious how long it had taken since the properties of rubber were first known to realise the purposes for which rubber might be used. After all, rubber was not an invention of yesterday or ten years ago, but it was only quite recently that the world had come to realise the place rubber was going to take in the arts and manufacturers of the world.

Prince Henry of the Netherlands, who was accompanied by the Dutch Ambassdor, visited the Exhibition on Tuesday. He was met at the ontrance by Sir H. Blake, the president of the exhibition, Mr. Staines Manders, the manager, and the representatives of the Netherlands. Miss Swart, a daughter of the chairman of the Netherlands Commission, presented the Prince with a bouquet, after which a tour of the exhibition was made, Prince Henry expressing himself as very pleased with everything he saw. Prince de Ligne, representing the King of the Belgians, also visited the exhibition.
—H. & C. Mail.

RUBBER PAVING.

In the "Engineering Supplement of the London *Times* of June 23, the following interesting editorial paragraph appears :—It is confidently predicted by the authorities of the forthcoming International Rubber Exhibition at the Agricultural Hall, Islington, that the paving of a large area of the hall with indiarubber will give a fresh impulse to the proposals which have from time to time been made for the use of this substance as a London road material. The arguments in favour of the adoption of rubber for road surfaces are its noiselessness and durability, combined with complete freedom from dust. It is, moreover, very readily cleansed, and being wholly nonabsorbent would not require much watering. Everything, however, depends upon the question of relative economy. It seems almost impossible to contemplate the use of rubber in this way upon a large scale unless the cost of the raw material should sink permanently to, say, two shillings a pound. Very favourable results are said to have been obtained by the employment of rubber blocks in roadways exposed to the heavy traffic, and the amount of wear after many years has been almost inappreciable. In fact, these experiments suggest that the material would in the long run be cheap as compared with wood paving or asphalte in consequence of its great relative durability and the absence of costly renewals. A careful and comprehensive test in a City thoroughfare would be of much interest.

LIBERIAN COFFEE.

The coffee-plant flourishes and reaches a size in Liberia to be found in no other part of the globe. The berries are larger and richer than those produced in any other country, and when properly cured possess the most delicious aromatic flavour. In Liberia two crops are gathered each year, one during the rains and the other during the dry season. The rains begin in April and May and close in October and November. The chief and most important coffee crop is gathered during the dry season, *i.e.*, in the months of December, January and February. When the coffee is picked the berry is usually crushed in a mill or mortar, and then spread on the ground in the sun in a prepared place until well dried. Every evening the coffee is removed in order to avoid its getting wet from rain or dew. When dried it is beaten in a mortar until all the pulp is entirely separated from the beans. It is finally cleaned by fanning, and some of the planters grade it by removing all broken and undeveloped beans. Liberian coffee is very strong, and is therefore used in Europe to give strength to weaker coffees. As generally prepared, it has a little bitterness in its flavour, and it is therefore often mixed with other coffees to overcome this.
—Royal Society of Arts Journal, June 23.

CEYLON AND ITS "PRODUCTS" AND "HISTORY."

"Coconuts," "Cocoanuts," "Cacao," "Cocoa-Gardens";—Why was "Ceylon" Taken by the British in 1796?

The "*Ceylon Observer*" has fought for 40 years to get rid of the erroneous spelling of the name of our principal Palm, and although its editor's opinion was scarcely once shared in the press (and books) during the "seventies" of last century, now it is very different. In England and America as well in the tropics, the correct form of "coconut" is fast prevailing. It is a pity that in a recent account of Ceylon in the London press from official quarters, there is nothing to help home readers to distinguish clearly between the palm and the "chocolate" or cacao bush; but rather, such spelling and reference that may well make "confusion worse confounded." For instance, what may not home readers understand when they come on: "A little higher up the monotony of the tropical vegetation is raised by the metallic foliage of *cocoa*-gardens, which presently, as the altitude increases, are replaced by low tea bushes, set in ordered rows, dotting the hills as far as the eye can carry." Curiously enough in this paper dealing with "landscape" as well as "history," there is not one mention of *the* Palm (Coconut) as a feature in the outlook, although the "Palmyra" is named; but among the products which have mainly caused material prosperity are mentioned the "*cocoa-nuts*"*—(pretty sure to be confounded by some stay-at-home folk, with "cocoa-gardens.")

In the brief sketch of history, it is a pity that one reason for the British interfering in Ceylon in 1795-96 is not mentioned, namely, that the object was to capture and hold the Dutch Possessions everywhere at that time, on behalf of the legitimate "Orange" family who were dispossessed by the Bonaparte's; and the Governor in Colombo (Angelbeck) was more than suspected of making the surrender to the British, easy, because he was a partisan of the Prince of Orange. At the end of the war, when the island had to be returned, it was decided to retain Ceylon and give Java in exchange—a far better bargain for the Dutch!

SOYA BEANS AND OIL.

There has been a considerable set-back in the export of Soya Beans from Manchuria and several reasons are advanced for the depression. Some are of the opinion that the Manchurian beans have not the commercial value originally claimed for them. Others again think that the oil has been found a more profitable line than the export of the beans themselves while yet again the suggestion is made that the success which has attended the experimental cultivation of the bean in the West makes it possible that in future, countries in these parts will be in a position to supply their own requirements. We give the following extract from an exchange on the Food Value of the bean. Two varieties of Soya may be seen growing at the Government School Garden in Colombo—one of these is a creeping species, evidently the variety recommended for green manure, while the other is already bearing pods, and is the variety which produces the beans.

* That is in the separate paper "Facts and Figures" (where most of the agricultural statistics, though not acknowledged, are primarily due to the "Ceylon Handbook and Directory"). The wrong spelling for the palm and products is adhered to in every case, although this error is now avoided by all Ceylon authorities. But most likely, for this, the London "printer" must be to blame.

FOOD VALUE OF SOYA BEANS.

The soya bean has lately came into some prominence by reason of its extensive uses in the manufacture of oil and soap, and because it forms return cargoes for tramp steamers bringing coal to the East. Dr. Gilbert Brooke, Port Health Officer of Singapore, describes some new uses for this article:—

The object of this paper is to show that we have at hand an article of diet which is cheap, which can be grown over large areas of the globe, which is palatable, which is not attacked by any known insect or fungus, which forms valuable by-products, and—most important of all—which contains, more nearly than any other known animal or vegetable substance, all the essential and properly proportionate constituents of a perfect diet.

Rice is a very badly balanced food, consisting mainly of starch, having next to no nitrogen, and hardly any fat or salts. In this rice stands, in the scale of food values, almost at the bottom, whereas the soya bean stands at the top. But it is remarkable that nature and experience seem to have taught rice eating races that one of the best accompaniments to rice is some form of leguminous food, such, for instance, as dhal, the small yellow pea so much used by natives of India. Following out this analogy it would seem to be most desirable to foster among Asiatic races that depend mainly upon rice as a staple the simultaneous consumption of the soya bean as supplying in abundance those essential food elements that cannot in the least be derived from rice.

Among the economic products derived from the soya Dr. Brook enumerates these:—

(1) Bean Curd.—A most nutritious jelly can be made from the soya bean. This has been known and widely used by all classes in north China for the last 2,000 years.

(2) Bean Milk.—The beans are dried, very finely ground, and made into an emulsion with water. This forms a valuable milk, which resembles cow's milk, in that it coagulates when heated and acidified. The possibility of this is due to the fact that the proteid is composed of casein, as in the case of animal milk.

(3) Bean Cheese.—A nutritious cheese is frequently made in Japan from bean milk.

(4) Bean Flour.—The dried and pulverized bean is most valuable as a soup basis. It is also useful for making biscuits and infant foods. Soya biscuits, produced by a Scotch firm, are supplied on several P. & O. mail boats.

DYSENTERY
is common in this climate. The treatment is absolute rest in bed and a diet restricted to MILK ONLY.

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(5) Bean Oil.—There is a very high percentage of fat in the soya bean. This is of commercial value. It is edible, and also forms an excellent basis for candle and soap manufacture.

(6) Bean Cake.—The seed cake left after expression of the oil from the soya bean forms one of the most valuable and rich cattle foods known.

(7) Bean Sauce.—The soya bean ground up and steeped in vinegar or brine forms a basis for Worcestershire and other sauces.

(8) Bean Coffee.—A substitute for coffee may be made from the soya bean, by a dry toasting and grinding it, then adding boiling cow's milk or hot soya milk.

(9) The straw surpasses in nitrogenous value that of wheat or even hay. It is quite possible that the leaves or root may have medicinal properties, but this has not yet been worked out.—*Home paper.*

ESTATE "BUILDINGS" AND "SOILS."

A planting correspondent writes:—"I remember seeing a good many years ago two very useful books often on planters' tables and referred to, but which have gone out of sight altogether so far as my experience goes. They were issued by the Planters' Association and were Prize Essays, I think, on Estate Buildings and the other on Estate Soils. They were nicely printed in London. Can you tell me anything about them and where copies can be got?"—Certainly, we reply; because the P. A. sold most of the editions to this office and a few copies remain, although not advertised lately. The Prize Essays on Estate Buildings with scores of diagrams and plans for Stores, Bungalows, Cooly Lines, Cattle-sheds, &c., were by Mr. J. de C. Ballardie and Mr. T. C. Owen—both still well-known in the London-Ceylon world; and well printed by "Strakers" and bound together make a handy octavo volume of about 200 pages in large type, the plans about 40 to 50 being all drawn to scale. Being published in 1879, "coffee" was still the staple; but most of the buildings are adapted to tea, rubber, &c. The price of the volume should be R6; but it can be got now for half or R3.

The other little book of 154 pages (also printed by "Strakers") is Mr. John Hughes' Report to the P. A. on Ceylon Soils and Manures, in a handy volume, R1·65, published; but can now be got for a rupee, and both will at once be re-advertised in view of our correspondent's enquiry.

TEA SHIPMENTS FROM CEYLON.

Matale E., July 12th.

Dear Sir,—Can you inform your readers :

1. Under what heading, if any, tea from India, and sold in the local market, appears in the Chamber of Commerce export table when the tea is re-shipped ?

2. What quantity of tea was shipped from Ceylon in June ?

3. How much of it was Ceylon grown ?

4. What is the estimate for July shipment ?
—Yours, etc.,

INTERESTED.

[We are unable to answer No. 1. Neither the Customs nor the Chamber of Commerce returns show this, though it is well-known that teas from India are brought here and sold for export in the public market weekly, such sales in June alone including some 3,324 chests and 518 packages according to Messrs. Forbes & Walker's Circular.

No. 2.—The export of tea from Ceylon in June was 19,667,102 lbs. of black tea and 672,993 lbs. of green, total 20,340,095.

No. 3.—*Vide* answer to No. 1.

No. 4.—The estimate of shipments to the United Kingdom for July is 9¾ to 10¼ million lb. There is no official estimate for other countries, but these may take about six million lb.—Ed. *C.O.*]

PEPPER.

Thero are three principal kinds of pepper—black, whito and red. They are divided into about 40 varieties of black, and 30 of white, and 25 of red. Black pepper is the green or unripe fruit of the pepper vine. It grows in clusters, very similar to currants, and is picked twice a year, dried either by the sun or artificial heat, and then shipped—handled about the same as raisins. When a pepper berry is cut in two you would note that there are three distinct parts, outer or black coat, second or gray coat and white center. The best grades are those which are nearly or entirely solid, thereby containing the most white meat. The low grades are almost like little empty puff balls. You can crush the berries between the fingers. These low grades come principally from the province of Acheen, in the Island of Sumatra. Although owned by Holland, the Dutch have never been able to conquer the natives, who still have their own rulers and are masters of the land, except a narrow strip on the coast. Naturally the methods of cultivation are very crude and the drying is done on the ground, and not much care is taken when shoveling that pepper into bags to leave behind sand, stones, and other dirt that happens to be there. Acheen is an important part of the crop, so the European traders have established standards whereby we have four grades :—

The "A" grade weighs 4 lb. 13 oz. to the gallon.
The "B" grade weighs 4 lb. 5 oz. to the gallon.
The "C" grade weighs 3 lb. 13 oz. to the gallon.
The "D" or lowest grade, weighs only 3 lb. 5 oz. to the gallon.

Of course, the poorer qualities are lighter ones and these fill up a gallon measure with the least weight. These several classes are made by immersing pepper in water. The best, or 'A' grade type, sinks to the bottom, while the poorest or 'D' grade floats on the top and is skimmed off. The intermediate grades, 'B' and 'C,' are mixtures of the best and poorest in different proportions. When the best pepper is ground a light gray powder is the result, while the poorer kinds yield a dusty black powder. The best known good pepper is that coming from Singapore. It is grown by Chinese or Malays and away from the influence of civilisation. It is dried over smokey fires which gives it a flavour by which this kind is recognised.

White pepper is not a natural product. To get it, the pepper berries are allowed to ripen thoroughly. During their later growth the black skin becomes loosened. When the crop is harvested it is all put into water to remain several days, being stirred around at intervals. The stirring is done often under pressure to hasten the process. This combined stirring and pressing is accomplished by having bare-footed natives walk around in vats. This causes the pepper skins to fall off more or less, so that when eventually dried it is practically free from its black covering and white pepper is the result. The practice of afterwards using bleaching powders has been done away with. There is quite a little pepper substance lost by the process, as the shell or outer black part possesses much pungency and considerable aromatic quality, besides pepper is at its best condimentally before it ripens. The fact has lead to an improved process, namely decorticating. By it the better or heavier varieties or black pepper are changed to white by mechanical means. The manner of doing this is by suitable machinery, to keep the berries in contact with a revolving stone, which at every turn scrapes off a bit of the shell and in the end there is left the smooth, round, white hearts of the berries. When these hearts, or centres, are ground, the result is a pepper almost pure white. This decorticated pepper found instant favour with chefs and stewards as a seasoning for potato salad and mayonnaise dressings, because its use did not leave in those things the little disfiguring black specks which are a part of black pepper or ordinary white pepper.

Red pepper grows in every part of the world except the North and South Poles and Tammany Hall. The hottest kinds, however, come from the tropics. It is there that real concentrated Hades is raised in the form of a small narrow pod from Mombassa and Zanzibar. These grow wild in the swamps in the interior. The climate back from the sea coast is fatal to white men, so again we have a commodity that is unimproved by civilisation. It is quite a job to grind these pods. They are tough, oily and very irritating to the miller and his workmen. The powder from these is what is generally known as cayenne or red pepper. Cayenne pepper comes from Natal, South Africa. The quantity produced is so small that it very seldom if ever is exnorted. Other kinds are produced in India, West Indies, Japan and Mexico and Texas.—*American Grocer.*

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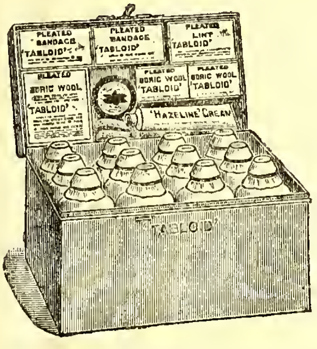
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REVOLUTIONARY CHANGE IN TREATMENT.

RESIDUE FLUID A VALUABLE ASSET.

A correspondent writes to the *Straits Times* of July 5th :—

What looks like a potential revolution in the process of converting latex into rubber is begun. The new era is not to be marked by any mere alteration in the present style of machinery or even in the chemical phase of the work ; it is to be effected by a wholly radical renewal of mechanical means. The existing system of coagulation and smoking is threatened with utter extinction and in its place is promised an entirely new mode that is said to be more economical, more scientific and, as a consequence, more materially effective. The advent of this latest system has been screened with something amounting to astonishing secrecy but some general details have become known. The actual and particular details may be expected shortly, for we understand that the apparatus, illustrating the innovation, is being exhibited for the first time at the Rubber Exhibition opened last week in London.

THE NEW PROCESS.

At present there is only one installation of the kind in use in Malaya and that is on the estate of a Belgian company at Kajang. There, in the factory, the new machinery is at work every day under the strictest supervision. The principal component of the installation is a big drum connected to a powerful gas plant. The latex is poured into the drum, which is then started to revolve at a lively pace. The action is to all intents and purposes an adaption of the simple milk-churn that every rustic dairy-maid in England is familiar with. The revolving of the drum creates a commotion among the latex and the thick of it rises quickly to the surface and forms a cake.

That essentially is the first part of the performance. But while the latex is thus being churned round, a heavy jet of smoke is forced upward into its midst and permeates the whole of the liquid, making it bubble like the water in a kettle. The smoke, which is purified by first passing through a mass of cotton-wool, is made to penetrate the latex by sheer pressure and in so doing antisepticises it more effectively than is done by the prevalent system. The result is a pure sheet, no less marketable by reason of the fact that it is not dirty with smoke.

The advantage, if all this is accurate, is obvious. The company which can turn out a clean rubber, antisepticised and less liable to be "tacky" than the smoked sheet we know, will command a readier market than the company which retains the crude method of belching unclean smoke into the open pores of the newly made rubber sheet. In the latter fashion it is the choking of the pores with carbonic dust that turns the sheet to its dirty brown ; and the manufacturer at home is put to the trouble of cleaning before he can use it for his best manufactures. If, on the other hand, the manufacturer can get a

sweet clean article that needs practically no cleaning he will assuredly take it and even offer, perhaps, a better price for it. As a well-known rubber man told us one day "You wouldn't buy kippered herrings if you could get fresh." And that more or less expresses the probable attitude of manufacturers.

TREATING "DIRTY WATER."

There is another lesson to be learned incidentally from this Kajang estate, and that is the value of the fluid left in the coagulator after the sheet has been skimmed off. This fluid in the past has been contemptuously regarded as nothing better than "dirty water" and it is no exaggeration to say that thousands of pounds have been thrown in the drains of the F. M. S. by reason of that view. That "dirty water," in the hands of a good chemist, is valuable. It stands to reason that it must contain a certain amount of latex that has not solidified, but although that must have been patent to planters since the beginning, it was never thought worth while to spend money in redeeming the latex. The Belgian company's work answers that. They have sent out a first-class chemist who has taken the subject well in hand. And at the moment, we believe. the company is being saved $200 a day that would otherwise be thrown into the river and lost.

RUBBER AND GUTTA-PERCHA IN BORNEO.

A great awakening took place in 1910 in regard to the value of native gums of North Borneo, of which there are four—gutta-percha, gutta-jelatong, gutta-jangkar, and rubber. About the beginning of 1909 a British company obtained a concession from the Raja to control the output of the forests of Sarawak, and a large plant for refining and preparing the gums was erected at the mouth of the Sarawak River, eighteen miles from Kutching. It is estimated that no less than 40,000 acres have been brought under rubber cultivation in 1910 in British North Borneo. This has greatly stimulated the demand for coolie labour, which is brought from Java, Singapore, and Hongkong, through agencies at those places. According to Government reports, there are now employed on the various rubber estates about 15,000 coolies. When the trees now being planted become productive, it is estimated that 50,000 coolies will be required. As this estimate is based on real plantings, there is a bright outlook for large expansion in the general commercial condition of North Borneo. —*Royal Society of Arts Journal*, June 23.

BRAZIL IN THE RUBBER MARKET.

We understand from our own sources of information that the floating supply of rubber in Brazil has been greatly reduced by private purchases, and it is probable that the maximum amount now awaiting delivery is 6,000 tons. This is about half the figure estimated a couple of months ago. If this process of absorption can be continued for a little while longer, it is evident that the general position of the rubber-producing industry will be very much better than at any time during the past twelve months. —*Stock Exchange Gazette*, June 15.

TO EXTERMINATE ANTS.

Many and various remedies have been tried, frequently in vain, to get rid of these troublesome pests. The following means are suggested in a recent number of the "Bulletin" of the Trinidad (W.I.) Botanical Department:—

For the extirpation of ants the following remedies are good. To be effective they require attention and perseverance. It is well to find their main burrow or nest, if possible. Arsenic is sure destruction to them, but it is dangerous to handle.

Air-slaked lime, plentifully dusted in warm, dry weather over and around the anthills or in the house or other places infested will cause the ants to vacate them in a short time.

SNUFF.—Dust a little snuff upon the floor of the rooms of the pantry.

Draw a thick chalk line round a smooth tree or across an upright board or post, and they will not pass over it.

CAMPHOR.—Put a piece of camphor, the size of a filbert nut, into 2 quarts of cold water. When cold, apply to pot and other plants, and the insects will be driven off without injury to the plants.

Mix together 1 part of calomel and 10 parts of finely powdered white sugar; lay it in little heaps about their nests and runs; the ants will eat it and die.

Coal oil, mixed with six times its bulk of water, sprinkled over the nests every few days, will kill and drive them away.

Pan or saucers nearly filled with honey or sweet oil attracts ants, and they are drowned in it.

Flowers of sulpher, ½ lb., potash 4 oz. Set in an earthen vessel over the fire until dissolved and united. Afterwards heat to a powder. Infuse a little of the powder in water, and sprinkle in places infested with ants.

TO DESTROY BLACK ANTS.—A few leaves of green wormwood scattered among the haunts of black ants will drive them away.

RED ANTS. — Powdered borax sprinkled around will exterminate both red and black ants.

THE DISTILLATION OF ORANGE FLOWERS AT GRASSE.

The distillation of orange flowers on the French Riviera, and particularly in the district surrounding Grasse, is a very important industry. Here 3,000 tons of these flowers are produced annually, not including the leaves and even the young fruit of the orange, which is also utilised for making the essential oil, so valuable in the manufacture of perfumes. The best quality of oil, called *néroli*, is obtained from the flowers of the wild, or bitter orange tree, locally termed *bigaradier*. The flowers of the sweet orange are not so productive, and yield a quality known as *néroli doux*, which is inferior to the other. A still more inferior quality is obtained from the *brouts* (the leaves and newly-formed fruit), this quality is called *petit grain*.

The flowers are gathered during the month of May. For their distillation an ordinary still may be used, but a special apparatus is preferable. These are of smaller size at bottom than those employed for distilling spirits, and somewhat highor; a grating is also provided, so that the flowers and leaves are not in direct contact with the fire. An ordinary-sized still should contain about 40 kilogrammes of flowers (88 lbs.), and between 50 and 60 litros (11 and 13 gallons) of water. This should yield from 30 to 40 litros (6 to 8 gallons) of liquid.

The products of distillation pass from the still into a receiver, so arranged that the condensed liquid always remains at the same level in it, the water is drawn off from the bottom by a bent tube, whilst the globules of essential oil that float on the surface are collected at the top of the vessel. The oil, though not very soluble in water, is sufficient to impart its perfume to it, and is sold as *eau de flour d'oranger*, whilst that obtained from the distillation of the leaves is termed *eau de broule*. A kilogramme of orange flowers yields, on the average, 2 grammes (30·86 grains) of *néroli*, worth from 500 to 1,000 francs per kilo (£9 1s. 7d. to £18 3s. 2d. per lb.). The orange-flower water is sold, on the average, at 25 centimes per litre (about 2½d. per quart.) The leaves yield about 1½ grammes per kilo of *petit grain*, worth about one-tenth the price of the *néroli*. The quantity of flowers furnished by each tree varies considerably, and depends on age, vigour of growth, situation, soil and other circumstances. A well-kept garden near Grasse, with trees, half of which were forty years and the other half twenty-two years old, has produced as much as 2,800 kilogrammes (about 2 tons 15 cwt.) in a single year. The cost of planting a hectare of orange trees is estimated at 4,000 francs, or about £65 per acre.—*Royal Society of Arts Journal* for June.

PALMYRA DISEASE.

We extract the following from a report on the bud-rot of palms in the Godavari and Kistna districts written by Mr Macrae, Entomologist to the Government of Madras:—

Species of palm attacked.—Four kinds of palm trees are common in the delta. Of these the palmyra palm, the coconut palm and the areca nut palm are all subject to the disease but the date palm has never been observed to be attacked. Many thousands of palmyras, several hundreds of coconut palms and a few scores of areca nut palms have succumbod. Palms of all ages are liable to attack but more mature palms die than young palms.

Symptoms and cause of the disease.—The first indication that a palm is diseased is usually the withering of one or more of the expanding leaves. The central bud dies and the leaves gradually wither one after another towards the exterior of the crown. When a deceased crown is cut open spots are seen on the leaf-sheaths and occasionally on the leaf-stalks and leaf-blades. At first these are light coloured but gradually become brown or even black when they have become dry and old. The spots are slightly sunken with a raised rim. On some of the spots a white wooly wel or mycelium is seen. This is the body of the fungus, *Pythium palmivorum*, which causes the disease. It is made up of many fine, colourless threads woven together. These threads produce small round sacks in which are developed the spores. They are tho reproductivo bodies of the fungus.

Many attempts have been made to cultivate the fungus artificially, but all have failed. It will grow only on living parts of certain palms. Some other parasitic fungi behave in the same way.

On an average the rate of extension of the disease as a whole seems to be a little over a mile a year. Except for an extension beyond Peddapur, for one up the right bank of the Godavari river in Yernagudem taluk and for the one to Masulipatam the area affected by the disease is continuous. The Imperial Mycologist writes :—"It is quite clear both from the observations made in the field during the past four years and from information gathered from the cultivators, that the spread has occurred in a centrifugal manner from the locality in tho Gautami Godavari first infected. Naturally the flow has been more rapid along some lines than others, and barriers such as the main channels of the river and tracts bare of palms have checked extension in some directions for a greater or less period ; on the whole, however, the onset has beon remarkably even and regular all round."

6. *Disease not Uniformly Distributed.*—Though, speaking broadly, the disease occupies a continuous area yet its distribution in that area is very uneven. In some localities many palms die continually, in others a few die now and again while in others only occasionally a palm succumbs. The Imperial Mycologist mentions a case in one of the lankas near the place where the disease is believed to have originated, in which 400 palmyras were found dead or dying in a single acre, and another case at Kolanka where 50 to 75 per cent of the palms within a mile of the village had succumbed by the end of 1907. "Such a high mortality cannot be equalled now in any part of the affected area." The intensity varies oven from field to field. Several cases have been seen where the disease is confined to definite topes of palms while topes in adjacent fields remain quite healthy. Dampness of soil favours the disease. Along water channels, on paddy bunds and on black soil the mortality of palms is greater and more rapid than in opener situations and on sandy soil.

7. *Means of Spreading the Disease.*—The chief possible ways by which the disease may be spread from tree to tree are—

1, by the wind,	3, by insects,
2, by tappers,	4, by birds,

1. *Wind.*—"Most epidemic diseases which resemble the bud-rot of palms are spread through the air. The parasites depend for their propagation chiefly on spores, which are set free and are carried into the air by the wind. Alighting on healthy plants they germinate and produce infection. Such are the potato blight, cereal rusts and the like. *Pythium palmivorum*, which is very similar to the cause of potato blight, produces spores which would be just as capable of causing rapid spread of the disease as those of the latter, provided that

they are formed in a position where the wind can easily reach them. This is not often the case, however, since spores have not been found on the surface of diseased crowns, except in the comparatively small number of cases in which the blade or expanded portion of the leaf, is attacked. In the large majority of cases the seat of attack is the compact mass of leaf bases, the leaf-sheaths, which form a tubular covering to the top of the stem. Having entered the outermost of these, the fungus grows in towards the softer underlying ones and usually does not begin to produce spores until several have been penetrated. Spores have never been found on the hard outer sheaths, but usually occur between the softer inner ones at some distance from the surface. Here they are not exposed to the air and cannot serve as an effective means of propagation. In some cases, however, the young leaf shoot at the apex of the crown is found to have been attacked in the portion which afterwards becomes the expanded "blade" of the leaf. This usually occurs while it is still small and hidden in the tube of leaf-sheaths, being the result of direct contagion from the latter. In a very few of these cases the parasite has been found still alive when the young leaf has pushed out into the air, and it is probable that, in periods of high humidity or during heavy dews, spores would develop in this situation, freely exposed to the wind. A second condition in which there may be air-borne infection occurs when the tube of leaf-sheaths begins to disintegrate as an effect of the disease. In old cases the outer leaf-sheaths wither and fall away and eventually nothing is left but a bare pole. In these old withered sheaths no spores capable of germination have been found, but it is quite possible that they occur, and if this is so, they would be a means of dissemination. A third condition is the result of the stripping of the outer leaves for thatching and still more in some localities for fibre. In the operation the old leaf bases are torn away, and it is not uncommon to see leaf sheaths that are still almost white from their internaal position, exposed. In infected trees this must offer considerable opportunities for aërial dissemination of the spores. It is doubtful how far the above conditions are sufficiently frequent to account for the intensity of the epidemic. It appears that if this were a common method of spread, the area affected would by now be far greater than it is. Airborne infection is always rapid and instead of the disease being confined to one small district, it would be found throughout the country." There is no doubt but that the conditions mentioned above do occasionally occur and that therefore the wind does play a small part in disseminating spores. This means of distribution is too fortuitous, however, to explain completely the steady spread of the disease.

2. *Tappers.*—"Dissemination of disease by human agency is particularly likely where, as in bud-rot, the diseased parts of the plant are habitually handled by persons who afterwards come into contact with susceptible portions of healthy trees. As already mentioned, each village uses the produce in leaves of a large uumber of palmyras for thatching. In addition a large number of trees are tapped for toddy and jaggery. Over 400,000 palms are tapped for jaggery in the Godavari district (mostly in the upland taluks) according to the Imperial Gazetteer. For both these purposes the bulk of the palms in the district are climbed at intervals. It is the practice of the climbers to strip off the outer sheaths, both because they impede their operations and because they serve for fuel. Hence the inner fresh, moist and softer sheaths are often exposed. In diseased trees this is just the position in which felted masses of the mycelium of the parasite are found. Fragments of the outer sheaths containing living mycelium no doubt often break off and remain on the person of the climber. The mycelium itself would readily adhere to his knife. It is easy to see that in repeating the operation in a healthy tree there is every chance of his successfully, if unconsciously, inoculating it with the parasite. There are indications in some places that the disease has followed lines of communication used by the people, particularly the ferries across the canals which intersect the district. These are no doubt used by the tappers and the matter would be explained if the infection is conveyed by them. In this district the coconut trees are not tapped for toddy and their leaves are rarely cut. Hence they are seldom climbed. Arecanuts are neither tapped nor are their leaves cut and when climbed it is only to remove the bunches of nuts, which project well away from the stem. It is possible that this explains in part the comparative immunity of these two species of palm."

It is not during the process of tapping that fresh palms are infected. The parts of the crown that are cut to get the juice do not often have the disease. It is while they are removing the lower leaf-sheaths to use as fuel and to a smaller extent when they do so to clear the way for climbing up, that fresh palms catch the disease from infective material adhering to the tapper's person and instruments. This, I believe, is the chief means by which the disease is spread in the delta. As it entails considerable exertion to climb to the top of a high palm, the tapper, while he is about it, removes in most instances as many of the lower leaf-sheaths as possible and leaves exposed the living, tender, pale, yellow leaf-sheaths within. Then the palm is exposed to infection from two other sources—(1) to a small extent from spores carried by the wind, (2) to some extent from spores and mycelium carried by insects.

Experiments were conducted at three places in the affected district in July and August 1910 to ascertain the method of infection. Mycelium and sporangia of the fungus were cultivated in as pure a condition as possible and then deposited on the surfaces of newly exposed leaf-sheaths of healthy palms.

On the 17th July the crown of a palm in which the central expanding leaf had become pale, was cut off in Rajabhupalapatnam in the morning and brought to Samalkota in the afternoon. The outer leaf-sheaths were removed till clean, young spots were exposed on the inner sheaths. Several of these spots were carefully cut out with a sterile knife and placed on a glass stand in a moist chamber. Next

morning the diseased spots had a copious growth of white mycelium on their surfaces. On microscopic examination this proved to be a pure growth of pythium. A small piece of mycelium was carefully removed, mounted on a slide under a coverslip in a drop of water, and irrigated with fresh water. In removing the mycelium care was taken to remove aërial mycelium only. All instruments and the water used had been sterilised. In half an hour the sporangia produced vesicles and on bursting liberated zoospores. This went on rapidly till most of the sporangia had discharged their zoospores within the next half hour. The material used for inoculating the first 15 palms was similar to the above. The water from the above culture on the slide was washed into a watch glass and a drop or two of this used to inoculate the last three palms. This, though not rigidly fulfilling the conditions of a pure culture, is the most that can be done with a holoparasite.

Eighteen young palmyra palms in one field of Bhimavaram village were consecutively numbered from 1 to 18. The only criterion of choice was that the palms should be small enough to be operated on from the ground. They varied from 3 to 12 feet in height. The outermost dry leaf-sheaths were removed. The inner dry ones had the attachment of one limb to the trunk severed while the attachment of the other limb remained intact. Usually 3 or 4 leaf bases were so treated thus giving access to the softer, less, changed, leaf-sheaths within. These half-attached leaf-sheaths were held aside, the inoculating material placed on the outer side of the uncut leaf-sheath just within the last half-attached one. The half-attached leaf-sheaths were then replaced in position one after another. A cord of fibre was then tied round to keep the leaf-sheaths in position. In a few cases a fold or two of the fibrous material attached to the leaf-bases was wrapped round the leaf-sheaths and wetted with water. All the operations were done to each palm before beginning the next one.

The surfaces of the newly exposed leaf-sheaths on which the inoculating material was placed were not sterilised. But as the leaf-sheaths fit very tightly together and were exposed for only a few seconds, it is probable that they did not contain any of the organism that causes this disease. The palms were chosen in a place in which it is known that diseased trees had not occurred

On the 18th of August the palms were examined and every one was found to have become infected with the disease. Three of them had died, *i.e.*, the growing point was dead. The number of leaf-sheaths that had been pierced by the fungus varied from 1 to 11. Diseased spots from the inner leaf-sheaths of two of the palms were placed in a moist chamber and developed aerial mycelium, zoosporangia and zoospores which were identical with those on the spots of the original diseased palm and are pythium palmivorum. This experiment was unexpectedly successful. It shows that when the conditions of humidity are suitable as in the monsoon a palm that becomes infected stands a poor chance of escape. In most of these cases the infective material was placed on the leaf sheath by means of a knife, either the small one ordinarily used for such work or the ordinary katti of the tapper. At Kothapota and Itampudi similar experiments were carried out and confirmed the above results. In each place a tapper inoculated some palms himself by passing the tip of his katti over a diseased spot and then touching the surface of the leaf-sheath of a healthy palm. These palms carry infection from one palm to another.

(3) Insects.—Two large insects common in the delta, the black rhinoceros beetle and the red palm weevil are capable of carrying the mycelium and spores of the fungus attached to their bodies and one or other or both are often found in borings in diseased trees. In several of the palms that were inoculated in the course of my experiments the latter insect was found. When a living leaf-sheath is wounded it exudes a sweet gummy juice and this seems to be the attraction. In nature the beetles and weevils get into the heart of the bud. The young pupae emerge within the disintegrating mass of tissue and observations conclusively prove that they carry the infective matter (mycelium and spores) from place to place within the limits of a single bud. The mycelium and spores of the fungus cannot well help becoming attached to their bodies and being carried away to healthy palms when the insects take to flight. The experiment has been tried of allowing a weevil to walk over a diseased spot bearing sporangia and then confining it in a cage on the outside of the leaf-sheath of a palmyra, but the results are not yet available. In Ramachandrapur, Lankalakoder and other villages the disease has been observed to be severe in the vicinity of the huts of the Midigas, a low caste of people who live on flesh. This has also been remarked near the huts of fishermen. The offal of carcases and fish afford good breeding grounds and the number of insects being greater in such favourable situations than elsewhere, the number of palms visited is greater. I am convinced that palm weevils and rhinoceros beetles play a part in disseminating the disease. Exactly to what extent has still to be found out.

(4) Birds.—Birds may conceivably spread the disease. If they perched on an infected part of a leaf or if they preyed on the insects that occur in the infected parts of the bud, mycelium and spores might easily become attached to their feet or bills and so be carried out to other palms on which they might alight. The affected parts of the leaves are seldom suitable places on which to alight, and what birds, if any, prey on rhinoceros beetles and palm weevils is not yet known. The opportunities that birds have of spreading the disease will only be occasional. Besides the rate at which the disease spreads is so slow and the progress of the disease is so steady that it is improbable that birds play any considerable part in the dissemination.

The evidence now available goes to show that the disease is spread—

(1) chiefly by palm climbers,

(2) to a smaller extent by insects (palm weevils and rhinoceros beetles),

(3) occasionally by the wind and by birds.

8. The length of time taken to kill a palm varies. At first when the disease is eating into the bud no sign of ill-health can be seen by a

person standing on the ground. Only by cutting off and examining the leaf-sheaths can signs of disease be detected. When the central bud has been killed the young expanding leaves become yellow. This is the first outward indication that anything is wrong. Now the growing point in the centre of the bud has been killed no new leaves are produced. There is then no hope of recovery. The palm, however, goes on living for a time on the reserve food stored in its tissues but the leaves gradually die till nothing is left but a bare pole. The number of leaf-sheaths that may be pierced by a series of diseased spots in a line varies. The highest number I have seen is 29. Even in this palm there were still 4 leaves besides the central bud untouched by the fungus. It must have taken several months for the fungus to pierce all these leaf-sheaths.

The length of time according to experiments from the infection of the palm till the death of the growing point and the withering of the central expanding leaves varies from one to ten months. From observations made in the field it is believed to extend to almost two years. From many enquiries made of residents in the delta it appears that the time that elapses before the palm is reduced to a bare pole may be up to three years or more.

Thus a palm may be affected from one to ten months or more before it shows visible signs of disease and after that may linger for upwards of three years. During this time there is very little hope of recovery from the disease.

9. *Recovery.*—A very few cases of recovery even after a great part of the crown has withered have been observed. This is due to the growing point having escaped injury. *Nearly all recovered palms succumbed in a comparatively short time to a renewed attack of the fungus.* I have seen only three examples of recovery. One of them subsequently died of disease and the other two were cut down in order to discover where the new shoot arose. It was found in both cases that the original growing point had been missed and had begun new growth. Thus out of thousands of diseased palms under observation since the operations were first instituted in 1906 only one case of recovery, that mentioned above, has been observed.

10. *Dormant condition of the fungus.*—The fact that these cases of apparent recovery almost invariably succumb later on, is an indication that the fungus is able to pass into a state of suspended activity. When the operations were begun it was frequently observed that even after a locality had been cleared of all dead and dying palms, new cases of disease continued to show. "At first these were believed to be new infections conveyed in some manner unknown. Then it was noticed that there was a difference in the distribution of these cases as compared with outbreaks which were undoubtedly due to fresh infections as when a village became attacked for the first time. In the latter case the deaths were in groups or often in one small part of a village only, indicating spread from one or a few early attacked trees. The deaths in villages that had been one or more times cleared of all outwardly diseased trees occurred scattered throughout the cleared area. In Amalapur village such scattered cases continued to recur with the greatest persistence. In two small areas kept under continuous observation which had been cleared of large number of diseased trees in November, 1906, five subsequent inspections up to September 1908, yielded fresh cases. It was impossible that outwardly diseased trees could have escaped cutting on these occasions, since the plots were close to the road through the village which was frequently traversed by those in charge of the work. Similarly outside infection was scarcely to be thought of for the whole village, as well as those adjoining had been very thoroughly and repeatedly worked over, being the head-quarters of the taluk where the campaign was prosecuted with the greatest energy. Examination of several of these cases showed that the outer leaf-sheaths bore unmistakeable evidence of previous infection, the old brown spots on the outer sheaths being split and dried up. The sheaths of at least two years' leaf supply often remain attached to the tree, and there was every reason to suppose that some of the spots seen on this and other occasions on the outer sheaths may have been two years old. It is now believed that such old spots may serve for a considerable time to restart an active phase of the disease. This is probably brought about through the tardy germination of resting spores, which have several times been found in the dried mycelial webs on the surface of old spots. The mycelial growth resulting from the germination of the resting spores is small and soon terminated by the formation of one or two sporangia. The spores from these would settle on the sheaths in contact and might succeed in penetrating them, whereas from their small number, and entangled position in the old sheaths there would be little likelihood of the sporangia being carried to other palms before germination." In my investigation in the Godavari I have several times seen unmistakable cases where the disease had become arrested within the bud. In one case near Vijeshwaram in Kistna district during an experiment an apparently healthy palm was examined. The disease was found to have penetrated several leaf-sheaths. The diseased spots were old and dry. These were cut away and several of the next inner clean leaf-sheaths were removed. Three months later the palm was still unattacked. It is still under observation.

Those who, while conducting the operations, have been living a considerable time in the district have observed that palms which have diseased spots on their expanded leaves invariably die.

The length of time between infection and the appearance of the first visible symptom has been proved by experiment to extend to ten months. From field observation it is estimated to extend in some cases up to almost two years. This accounts in a measure for the numbers cut out month after month in some places. These are not all cases of new infection but are the visible results of infection that took place months before. This is another factor that has prolonged the operations.